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The AUTOMOBILE

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Number 9

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NEW YORK, MARCH 2, 1922

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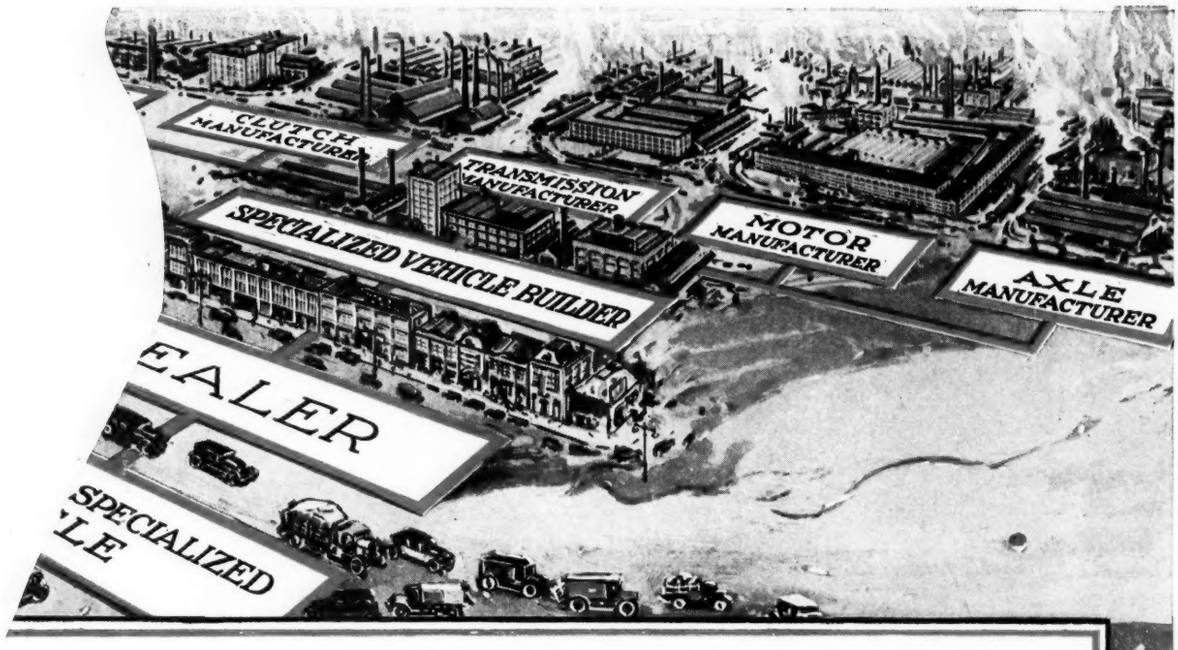

Unique responsibility backs every genuine SPECIALIZED vehicle

Visualizing the manufacturing method that produces genuine SPECIALIZED vehicles emphasizes the vast responsibility that insures their excellence. For back of the builder of a SPECIALIZED vehicle and back of his guarantee, are the great unit manufacturers of the automotive industry. These organizations which have SPECIALIZED on perfecting individual units, reinforce the guarantee of the vehicle builder by standing squarely behind their own products. Thus, the units that make up a genuine SPECIALIZED vehicle are guaranteed both individually and collectively.

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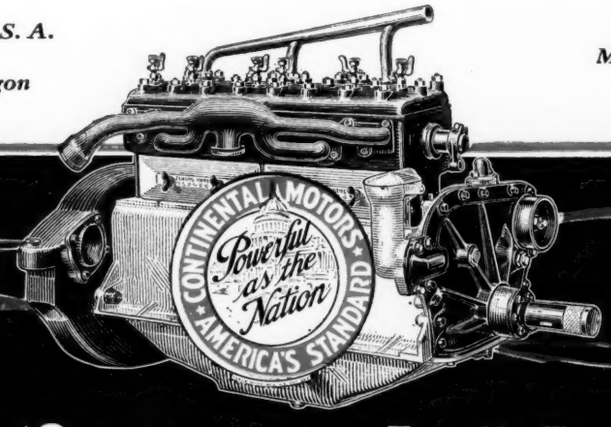


Continental Motors

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XLVI. NEW YORK—THURSDAY, MARCH 2, 1922 No. 9

Can Airships Be Made Fireproof?

The recent Roma disaster brings this question vividly to the fore. We have asked the foremost American authority on lighter-than-air machines to write his answer. He does so here in the most significant article that has been presented on this subject.

By Ralph Upson*

PRACTICALLY every new aircraft accident is from some new cause, yet the large percentage of cases where fire ultimately plays a part is evident to the most casual observer. Even with airplanes, fire is to many persons the most dreaded of any occurrence; and with airships, which are so very safe in most respects, fire is unquestionably the one big risk.

In the past the prevention of airship fires has been attempted mainly by attention to the original causes. This is done by confining the possibility of sparks and flames to properly protected positions. In effect we do the same thing in our houses when we surround our heating, cooking and lighting installations with proper safeguards. It may easily be claimed that almost any fire is due originally to *someone's* carelessness or ignorance. Yet it is equally true that disastrous fires are possible and will continue to occur as long as we use houses largely built of wood. The same is true of airships, unless in some practical way they can be made fireproof. The question is "Can it be done?"

In present-day airships there are three dangerously inflammable elements: gasoline, hydrogen, and the fabric of the envelope. They are particularly dangerous in combination. The gasoline, by its very nature, is in direct contact with flame in the engines; once ignited, its proximity to the envelope makes possible the burning of a hole through it; the escaping hydrogen then ignites and rapidly spreads the fire over the entire ship. Or the process may be reversed, as it was in the case of the "Roma," where the hydrogen was probably the first to be ignited through a rent in the envelope.

As the hydrogen is in any case the greatest *potential* source of danger, the most obvious remedy is to substitute a non-inflammable gas—hence the development of helium. In proper combination with other safeguards, there is no question as to the ability of helium to do what is claimed for it in any single-envelope airship. Here it is not only non-inflammable itself but will also check any spreading of an envelope fire. In a typical "rigid" airship, however, there is still the liability of the outer cover to burn away and with it enough of the inner gas cell fabric to allow a quick escape of most of the gas.

Helium also has the following practical disadvantages, particularly applying to its commercial use:

*Chairman of Lighter-Than-Air Division, Aeronautic Safety Code Committee.

Limitation of supply to certain natural gas fields, of which there are only 11 or 12 known in the entire world.

The small percentage available, almost never more than 2 per cent by volume, of the natural gas in which helium is found.

The difficulty of separating the helium from other constituents. The only satisfactory method so far discovered is by liquefaction and partial distillation.

Expense of Helium

The above three items make helium *extremely* expensive. The production cost alone is fully 100 times the cost of hydrogen in similar quantities. Add to this the bottling and transportation over long distances with attendant leakage, and it becomes simply prohibitive for practical commercial use.

But still there is another disadvantage that is almost as serious — its deficient lift compared to hydrogen. The accepted standard of quality for helium gives it about 10 per cent less lift than a good commercial hydrogen. This means that the average paying load on a commercial airship would be reduced by nearly half, or the fares, etc., would be practically doubled from this cause alone. In this I have not considered the possibility of a slight admixture of hydrogen, nor, on the other hand, the probable greater weight of fabric and equipment on a helium ship.

Among the remedies that have been proposed for some of these difficulties may be mentioned the following:

1. The sale of various by-products from the original natural gas in order to bring down the cost of the helium. Such products exist, but in most cases they are not true by-products because their extraction is a very simple process compared to that of helium.

In other words, the "cost" of helium may be reduced by applying to it the profits made in some lucrative side business.

2. The use of hydrogen for the main part of the volume, with a layer of helium used only around the outside.

The only things this would help would be the gross lift and the provision of a cheap gas for occasional maneuvering purposes.

The gain in lift would probably be more than offset by the extra weight of the envelope and balloonets, and the loss of gas by diffusion and contamination would be approximately doubled.

3. The use of purification plants at every terminal to keep up the quality of the gas and to avoid the necessity of occasional reinflation.

There are many cases where this would certainly be less expensive than getting all new gas from a distant point.

4. Use of ballast recovery and temperature control apparatus on board to avoid the loss of gas for counterbalancing fuel loss and for maneuvering purposes.

I have been assuming, in any case, the use of some form of ballast recovery equipment.

Temperature control would usually be worth while only on a helium ship, but would, of course, cut down still further the useful lift.

5. In a helium ship the engines might safely be put within the hull, and it is claimed by some that this would permit great savings in resistance and weight, but a thorough analysis of the proposition fails to show the probability of *any* net gain. In other words, we would leave our engines outside on most helium ships as well as on hydrogen ships. The principal exception is in cases where reducing gears are to be used. Then the engines can be mounted inside the hull without so much additional weight.

Summing up the possibilities of helium, we may say that it offers one solution to the problem which should be very effective for military purposes. But there are serious difficulties attending its commercial use for which there seem to be no immediate remedies. As to what alternatives are available, we must again consider the three main inflammable elements: fuel, lifting gas, and envelope. Generally speaking, the ship will be safe from destruction if any two of these can be rendered non-inflammable. The only alternative not involving a change in the gas is to make non-inflammable the fuel and envelope.

It may seem paradoxical to talk about a "non-inflammable" fuel, but heavy fuel oil, to take the best example, *is* non-inflammable, so far as requirements for safety are concerned. It is not readily vaporized and can only be ignited in finely divided form, such as is provided for in the engines themselves. Even kerosene is a comparatively safe fuel. Several promising developments of kerosene and heavy oil engines for aircraft are already under way, and it is practically certain that something satisfactory will be worked out along this line in the rather near future.

Non-inflammable Envelope

The remaining problem is to produce a non-inflammable envelope. Practically, this means the development of an all-metal ship. In such a ship hydrogen would be as safe as helium. For, even assuming a gas leak were ignited in some way, it would only burn as a jet, the same as any gas jet, with no effect on the operation of the ship.

Many other advantages of an all-metal construction are only too obvious and need not be listed here. But there are many difficulties to be overcome to make it a reality. In the meantime prevalent designs of fabric or fabric-covered airships can and will be used with increasing safety, due to accrual of knowledge and experience. In this several of the European countries are in the lead. But the biggest development is yet to come, and opens a wonderful field for American ingenuity and perseverance.

PRACTICAL, commercial problems, as well as theoretical engineering problems, must be met in the development of civil aviation. The substitution of helium for hydrogen gas will render airships far less inflammable, but limitation of supply and high cost render such substitution impracticable from a commercial standpoint at the present time.

Mr. Upson points out as well that the lifting power of helium is about 10 per cent less than that of hydrogen. He outlines the remedies proposed for the difficulties involved in the use of helium, and discusses the possibility of rendering airship fuel and envelope non-inflammable.

If the envelope can be made non-inflammable, hydrogen could be used as safely as helium, since a gas leak, if ignited, would simply burn as a jet.

New Engine Designs at Motor Boat Show

Marine engine development during the past year has been confined chiefly to the very large and the very small sizes. Electric lighting and starting has become a standard feature on larger engines. Some designs are suggestive of aircraft practice. Several 2-cylinder outboard types shown.

TO judge by the marine engines exhibited at this year's motor boat show, which closed in New York, Feb. 26, recent developments in that field have been confined mainly to very small and very large sizes. There has been a considerable increase in the number of small outboard engines, and there were also many large Vee type Otto engines as well as several Diesel engines. Steam also is making its appearance in the motor boat field, and two complete steam power plants, including boilers and engines, were exhibited. Taking the engine exhibits as a whole, a notable improvement in design and in quality of finish is noticeable. Marine engines some years ago were generally quite crude, and this appearance of crudity was emphasized the last few years by the makeshift mountings of electric generators and starters, but most of the engines at this year's show employed one or the other of the S. A. E. standard mountings and therefore presented the appearance of well thought out jobs. In outside finish there also has been a great improvement.

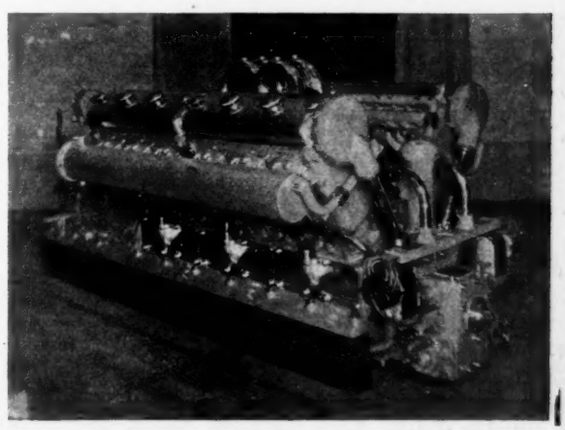
Designers of marine engines seem to be going in for overhead valve engines more strongly than automobile engine designers, and practically all of the overhead valve marine engines have overhead camshafts. Automobile engineers are going rather slow on overhead camshaft engines, because they realize the difficulty of making such engines operate quietly, but in marine work quiet operation does not seem to be considered essential, at least not in the same degree as in automobile practice. These overhead camshaft engines are mostly of large size. They include all of the twelve-cylinder and most of the six-cylinder models shown.

Electric lighting and starting has become a standard feature on boats of the larger types, and practically all of the engines with four or more cylinders were fitted with generators and starters. The makeshift mountings of these units, so conspicuous at former shows, are a thing of the past, and practically all of the installations observed were well carried out. In connection with this trend to provide generators and batteries as regular equipment in boats, there is a noticeable tendency to adopt battery ignition, this tendency being especially apparent in connection with the engines in the lower price range.

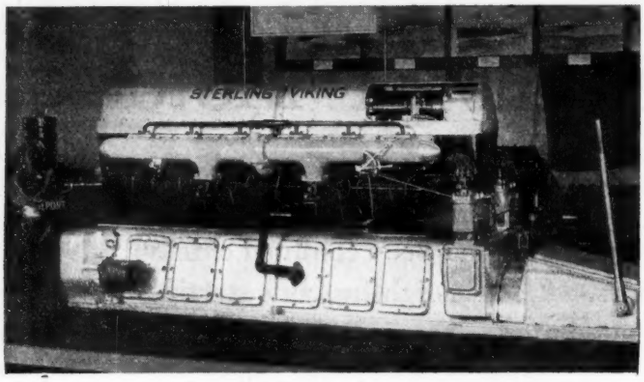
Diesel engines were exhibited by Winton, Sperry and the New London Ship and Engine Co. The engines on the Winton and Nelesco stands were large six-cylinder machines, the Nelesco having been built for use on a canal boat. The New London concern also showed a 100-hp. German M. A. N. Diesel engine, for which make it holds the American manufacturing license. The Sperry engine shown has a rating of 20-hp. and is of the compound type. This engine has been under development for a number of years and has been built for the Government in several sizes. We expect to print a description of this engine in an early issue.

A matter that has caused considerable disturbance in the marine engine industry recently is the refitting of discarded or surplus aircraft engines for marine purposes. On the one hand such converted engines with reversing gear were offered to purchasers at the show, while on the other hand purchasers were being warned against all engines not specially designed for marine work. The argument in favor of the converted aircraft engine is that it can be purchased at a comparatively low price. It is further argued that the engine has been designed to deliver a certain fixed horse power, and as long as it is in good condition it will deliver that horse power no matter where it is installed. The engine, it is said, does not know where it is mounted and furnishes power equally well in an airplane, a boat or an automobile. The warnings referred to emphasized the running cost and alleged that the airplane type of engine was not as reliable and durable as a marine engine should be.

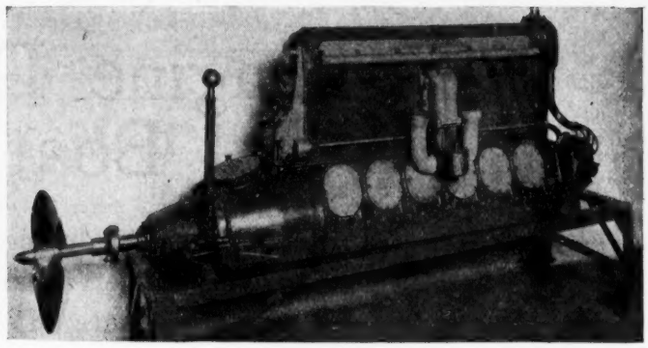
There were several engines shown which, while suggestive of aircraft practice, are still strictly marine engines, being much heavier than would be permissible in aircraft work. An example of this class is the Allison engine manufactured by the Allison Engineering Co. This is a twelve-cylinder Vee engine, delivering 300 hp. at 1000 r.p.m. and 425-hp. at 1500 r.p.m. The cylinder dimensions are 5½ x 7½ in. and the engine complete weighs 4400 lbs. The crankshaft is of the seven bearing type, 3½ in. in diameter and hollow. Crankshaft and connecting rods are forged of chrome nickel steel and machined all over, which gives an idea of the quality of design and construction. In fact, it will be observed from the brief description here given that aircraft engine practice has been followed to quite an extent, but the speed has been kept down and special attention has been paid to the requirements of rigidity and durability in marine practice. The cylinders are cast of semi-steel, the upper half of the crankcase is an



Allison twin six Vee engine



The new Sterling Viking six-cylinder engine



The six-cylinder, completely enclosed Isotta-Fraschini

aluminum casting and the lower half a manganese bronze casting. This lower half carries the crankshaft bearings. There are four valves in the head of each cylinder. The two overhead camshafts are driven through shafts parallel with the cylinder axes at the forward end of the engine. There are three spark plugs in each cylinder. Two of these plugs are connected up to magnetos, the engine being fitted with two six-cylinder dual spark magnetos, while the third plug is connected to a battery ignition system. As might be expected, lubrication is by the pressure system, and an electric starter and generator are fitted. The price of this engine with reverse gear is $25,000.

The same company exhibited a marine generating set comprising a four-cylinder vertical engine direct connected to a generator. Outputs of either 3 or 4 kw. can be obtained from the same unit, evidently by varying the running speed, and the generator can be wound for either 32 or 110 volts.

The Sterling Engine Co. exhibited two new six-cylinder models, of 150 and 300-hp. rating respectively. Both of these have overhead valves and overhead camshafts, the larger engine having dual valves. A feature of this machine which is found in very few marine engines so far is removable cylinder sleeves. The advantages claimed for the sleeve construction are that in the event of wear a sleeve can be easily replaced, and that, since the sleeves are machined both inside and out, there is less chance of distortion in service and consequent leakage and inefficiency. One point that is not being mentioned but which very likely has had considerable weight with the manufacturers is that this method of construction greatly simplifies the foundry problem in connection with producing the cylinder casting. The cylinder block—or water jacket, whatever one wants to call it—is a single casting extending the whole length of the crankcase, and this, of course, tends to greatly stiffen the crankcase. The lower half of the crankcase, which supports the bearings, is made of aluminum for express cruisers, and of cast iron for heavier boats. The upper half is in every case made of aluminum. The crankshaft is made of chrome nickel steel, with seven bearings. This same steel is also used for the connecting rods, which are of the tubular type. It will be noticed that these engines also embody the highest grade construction practice. Pressure feed lubrication is used, the oil being fed under pressure even up to the piston pin bearings. The system employed is that known as the dry base system, which was developed in connection with aircraft work, and which should have advantages in marine work also, especially in rough weather. Aluminum pistons are used in these engines. Ignition is by the battery system. The cylinder dimensions of the two engines are 4-11/16 x 6 in. and 7 x 8½ in.

A 400-hp. engine with overhead valves was shown by the Peerless Marine Motor Co. It is a 12-cylinder Vee type and weighs only 1400 lb., according to signs displayed, which is a remarkably low weight. This company also exhibited a 125-hp. 4-cylinder engine said to weigh only 750 lbs. and claimed to be the world's lightest marine engine. On the twelve-cylinder the starter and generator are mounted behind the engine proper on the reverse gear housing.

Another big engine known as the Smith marine twin six was exhibited by the New Jersey Motor Sales Co. It has Liberty 5 x 7 in. cylinders and weighs 1250 lbs. The rating is 450-hp.

A pair of very neatly designed engines, a six and a four, were shown by Isotta-Fraschini. They are completely enclosed and have very trim lines. At the front end of these engines there is a cross shaft which drives the magneto from one end and the generator from the other. The starter is fitted to the side of the engine and is geared to the fly wheel. At the rear end of the engine there is an aluminum casting which apparently serves as a jacket cover and which also forms the instrument "board." On it are mounted a tachometer, an oil circulation gage and an oil pressure gage. The camshaft drive is symmetrical in front of the engine. The water pump is of the eccentric type and is mounted on the forward extension of the crankshaft.

Murray & Tregurtha showed a pair of overhead camshaft engines. One of these was obviously a racing engine of very light design. There are two camshafts on this six-cylinder engine, one for the inlet and the other for the exhaust valves. Each camshaft is enclosed in a cylindrical camshaft housing and operates the valves directly through the intermediary of pushrods having their guides in the housing, so that the usual valve rocker levers are dispensed with. Means for the adjustment of the valve clearance are provided on the projecting portions of the push rods. There being push rods between the cams and the valve stems, the camshafts naturally are located a considerable distance above the cylinder heads. Their housings (of aluminum) are supported on the cylinder heads by means of steel studs or columns. This makes a rather light and simple construction.

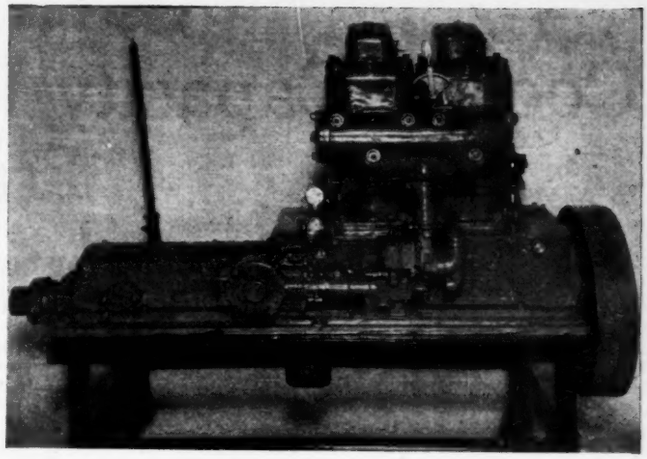
In outboard engines several two-cylinder types are now being offered. These engines are of the two-stroke or two-cycle type and the object in making them in two-cylinder form, notwithstanding their small output, is to improve the balance. The cylinders being arranged horizontally on opposite sides of the crankshaft, to gain this end it is necessary to use a two-throw crankshaft and to have the two cylinders fire at the same time. Formerly flywheel magnetos were the almost universal equipment on these engines, but now an option on either battery or magneto ignition is given by most makers.

Strong efforts have been made to reduce weight of outboard engines. The new 2-cylinder Elto, rated at 3 hp.,

weighs 48 lb. The Johnson outboard engine weighs only 35 lb. and is probably the lightest engine of this type made. A material reduction in weight has also been made by the Evinrude Motor Co. in its new 2-hp. outfit.

Motor-boat service is very similar to tractor service, in that the engines have to operate at nearly full load practically all the time, and it is therefore not surprising that a number of firms which specialize in tractor engines should also build marine engines. When Joe Van Blerck got out his new J. V. B. engine he at once offered it in both a tractor and a marine type, and now the Stearns Motor Mfg. Co., another manufacturer of tractor engines, has also entered the marine field.

An historical exhibit of interest was shown by the Consolidated Shipbuilding Corporation in the form of a naphtha launch built about 35 years ago, before the advent of the gasoline motor boat. Its powerplant operated on the same principle as a steam power plant, but low boiling point naphtha was used as the working fluid. Sectional diagrams of the working mechanism were shown mounted on a board, and it was stated that these launches enjoyed considerable vogue for several years, but that when the gasoline launch appeared on the scene the demand for them decreased.



Two-cylinder model of the new Frisbie heavy-oil type engine

A New Motor Operated Horn

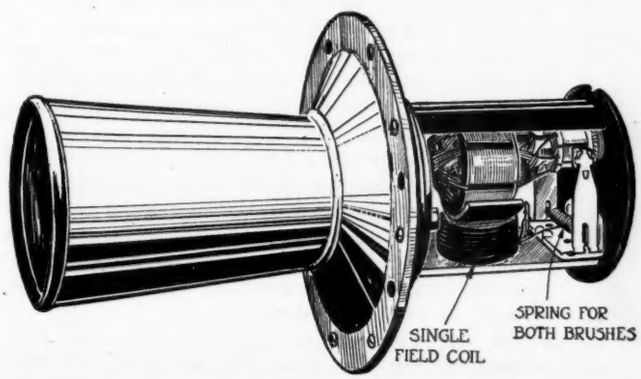
BY the use of a novel construction for the motor, the Briggs & Stratton Co. have been able to use a single field coil in the new motor-driven horn which they have recently brought out. The new construction has so simplified the manufacture of the horn that, based on a quantity-production basis, the horn will have a list price of but $5. There is a minimum of interior wiring. The horn is a concentric type.

In the design of the horn an effort has been made to remove the necessity for attention on the part of the owner or service station. It has been found that a large percentage of horn trouble usually encountered is due to either too much or too little lubrication. On the new horn a specially impregnated fiber is used which eliminates the necessity for lubrication and also is designed to exclude moisture.

An unusual feature in the motor is the new brush rigging which has been designed with the intention of making it impossible for the brushes to stick. The brushes are not lubricated, as there is one carbon and one copper brush. By the design of the brush rigging with a single coil spring between the two brushes, which are mounted on a sub-assembly, equal pressure is always exerted on the brushes. As shown by the sketch, the brush replacement is very simple.

The horn has been so designed that the cover can be easily removed and parts disassembled by removing two nuts, making it a simple matter to replace any worn parts. The horn can be taken apart so quickly that the customer can be informed at once exactly how much it will cost to make any replacements. This quality permits the service station to make the profit on the merchandising of material rather than on labor, and at the same time cuts down the amount of time the car is tied up for horn service.

Adjustment of the horn can be made externally by the use of a screw driver. The slot is so sized that a coin can be used if no screw driver is available. Two types of brackets are provided so that practically any car can be fitted. There is only one type of horn manufactured, but provision is made for a 12-volt circuit by putting on an external resistance. This eliminates the necessity for carrying more than one type of horn in stock. An important claim which is made for the horn is that the design is such that changes in weather conditions do not affect it in any way.



Detail of the new Briggs & Stratton motor operated horn

Auditing, Theory and Practice

THE third edition of "Auditing, Theory and Practice," by Dr. R. H. Montgomery, has just been published by the Ronald Press Company. The present edition is in two volumes and the second will not be ready for distribution for a few months.

This book, which has long been recognized as an authority on matters of auditing and accounting, has been brought up to date. Changes in economic conditions brought about by the war necessarily led to changes in systems and methods, and these are all brought out by the author. It is for this reason that the book is actually a new book rather than a new edition. Fully 200 of the pages are entirely new text.

The first volume of the book deals with the general principles of auditing and the second to the application of these principles.

THE weight of Haskelite Mfg. Corp. quarter-inch body panels is given as .073 pounds per square foot in the Feb. 16 issue. The weight should have been given as 0.73.

Cooling Capacity Increased in Samson Tractor

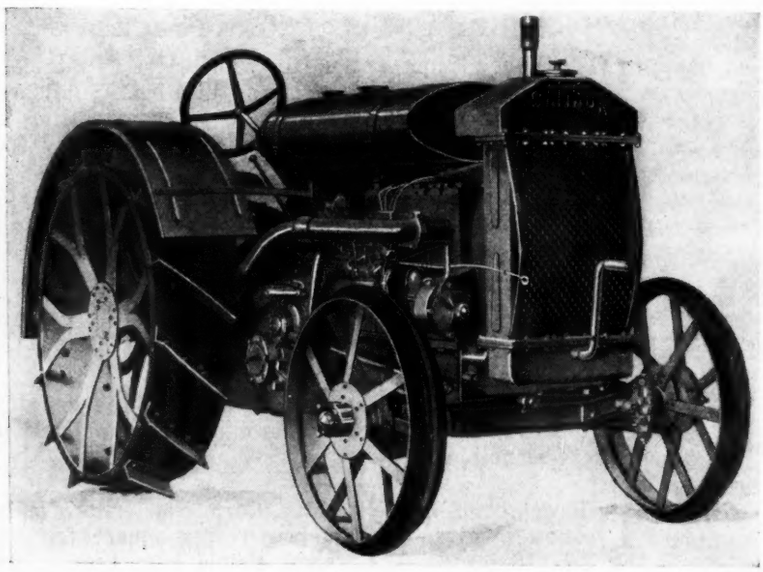
Improvements in lubricating and cooling systems have recently been made in the Samson Model M tractor. Cooling capacity is materially increased by enlarging radiator and fan. Here is the first detailed engineering description of this tractor with sectional view of chief components.

By P. M. Heldt

ALTHOUGH the Samson tractor is not a new product, a technical description of the machine at this time should prove of interest because no sectional views of the chief components have ever been shown in the past and very little is known concerning the internal construction of the tractor except possibly to service men and some users. Since it was introduced in the fall of 1919 this tractor has been widely distributed, and it has been decided to continue the same model for another year, with improvements as indicated in the course of this article.

As shown by the photographs, the tractor is of the frameless type, the engine being bolted with its bell housing to the forward flange of the transmission, which latter forms a unit with the rear axle housing. The tractor is of the lighter and more compact type and is geared to operate at slightly over 3 m.p.h. in light soil.

The engine is a four-cylinder block-cast type of 4-in. bore and 5½-in. stroke. Its cylinders are of the L-head type, the valves being seated directly on the cylinder casting, which tends to insure effective cooling. The compression chamber, which is made comparatively large so as to permit of the use of kerosene as fuel, is formed by the union of the removable head and the cylinder block. There are communicating passages between the jackets of the cylinder block and the cylinder head, so that the heads, too, are effectively water-cooled.



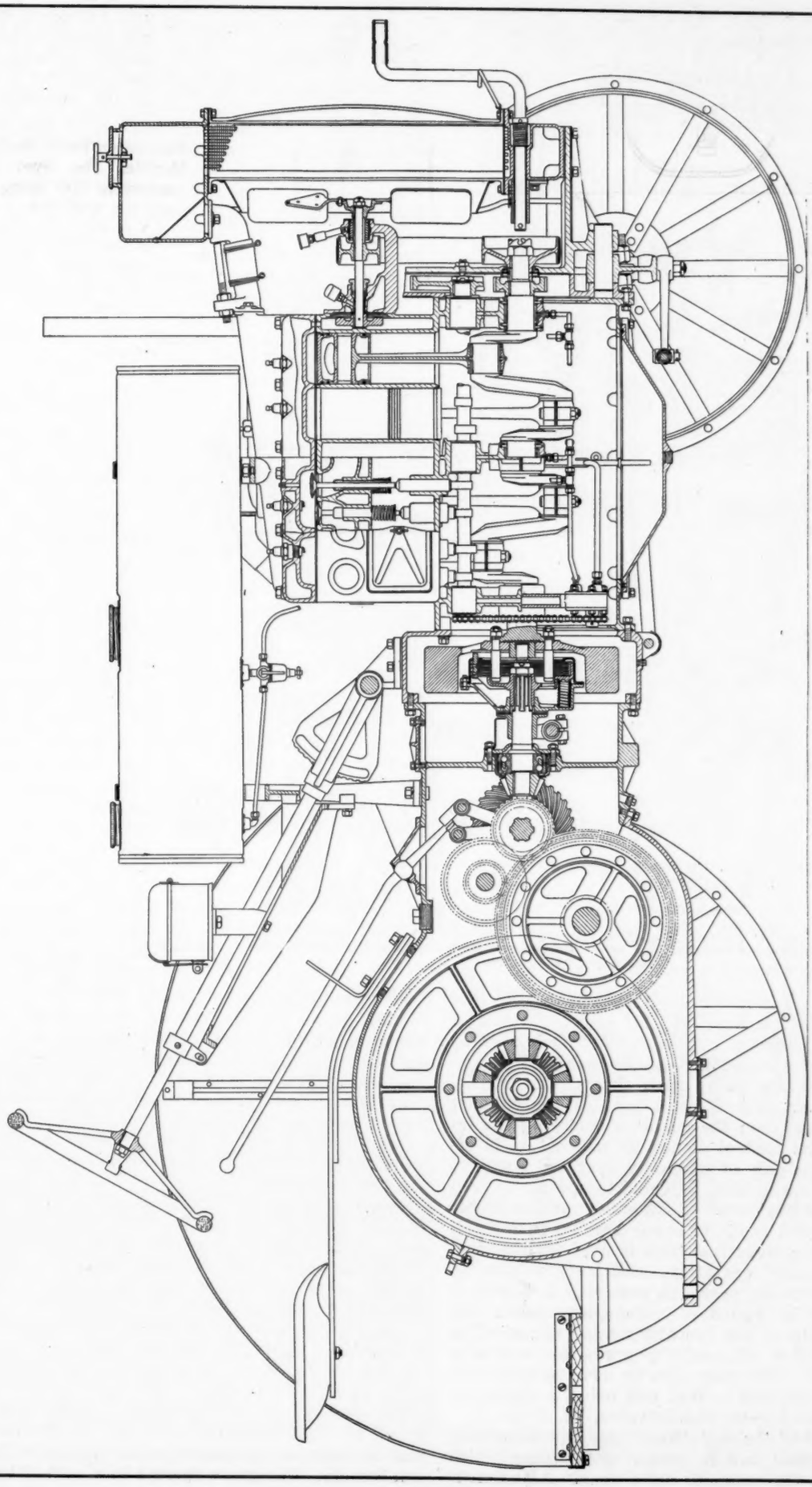
Samson Model M tractor

The crankshaft, camshaft and connecting rods are heat-treated steel forgings. All bearings on the crankshaft are of a dense babbitt alloy, brass-backed, while the camshaft runs directly on the cast iron of the cylinder casting. The pistons are made of cast iron and are fitted with three compression rings above the piston pin and an oil scraper ring near the lower end of the skirt. The timing gears are of cast iron and are cut with helical teeth.

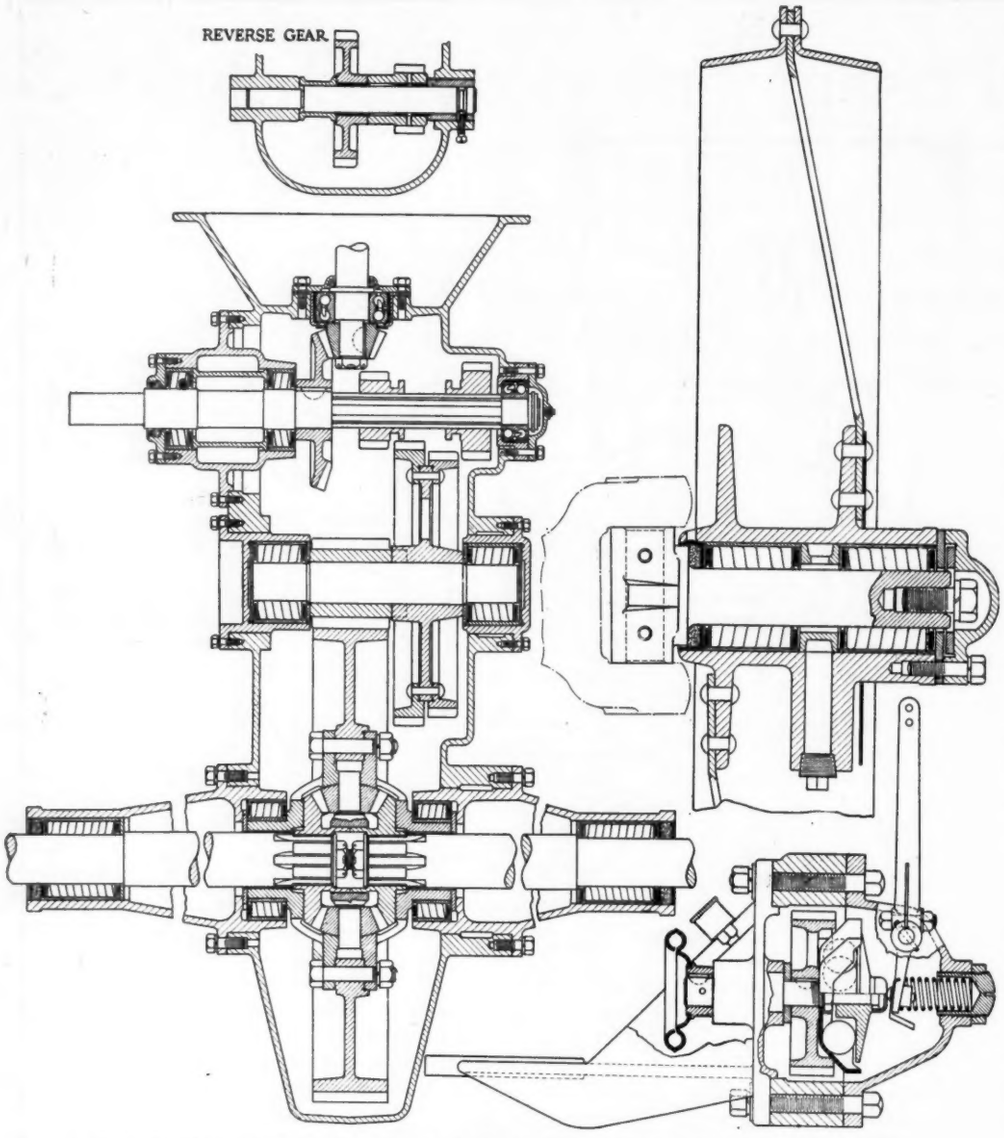
Lubrication of all engine bearings is accomplished by pressure feed from a gear pump located in the bottom of the crankcase, and oil thrown from the crank arms and connecting rod cheeks furnishes lubrication for the pistons, piston pins and valve tappets. A removable cast iron oil pan permits easy access to the interior of the crankcase for inspection and minor repairs. There are no oil line connections or other attachments to this pan. An improvement made to the lubricating system during the past year consists in the provision of an oversize oil pump with a by-pass valve, which results in a degree of uniformity of oil pressure on all bearings regardless of the temperature or fluidity of the oil. The overflow from the bypass valve is used to lubricate the timing gears and governor mechanism.

Circulation of the cooling medium is effected by means of an impeller of the type used in centrifugal pumps, which operates in a housing cast integral with the cylinder block. A large diameter pressed steel fan is mounted directly on the pump shaft and the pump and fan are driven from the crankshaft by a single belt. The cooling system, too, has been redesigned during the past year, with the object of adding to its cooling capacity. A radiator of increased capacity, though of the same general type as the previous one, has been adopted, and the fan has been considerably increased in size and its speed has been raised to give increased air flow. Formerly a plain bearing was used on the fanshaft, which now has both a plain and a Hyatt bearing. A flat belt has replaced the vee belt and is kept taut by a spring tension idler. The radiator consists of cast iron top and bottom tanks and cast iron side columns, which parts enclose a finned tubular core. Water is used as a cooling medium in warm weather and kerosene in winter in cold climates.

An air cleaner of the wet type is furnished, which was specially designed for this particular tractor. The necessity for frequent carbureter adjustments is said to have



Longitudinal section through tractor



On left—Horizontal section through transmission and rear axle. On right above—Section through front axle, showing roller bearing mounting. On right below—Section through engine governor

been eliminated. Particular interest attaches to the manner in which the heat of the exhaust gases is utilized for vaporizing the commercial kerosene used as fuel. A combined exhaust and intake manifold is provided, the construction being such that at the will of the operator all or only a small part of the exhaust gases can be passed over the surfaces enclosing the intake passage. The control device by which this is effected comprises a pair of manually operated butterfly valves. A single carbureter, adjusted to operate in conjunction with the heat control system, serves to meter and spray the liquid fuel. Gasoline carried in a small compartment of the large fuel tank is used for starting. After a few minutes' operation, sufficient to heat up the walls of the intake passages, kerosene is admitted to the carbureter by means of a three-way valve. By the same movement of the operator's hand the gasoline is automatically shut off, and the operation continues with kerosene. Gasoline may also be used as operating fuel, all that is required to that end being a slight adjustment of the carbureter needle valve.

The governor is of the centrifugal type and is entirely enclosed. The flyball unit is driven by a spider which is combined with the magneto drive gear. Adjustment over a range of speeds from 900 to 1500 r.p.m. is accomplished by means of an adjusting screw in the front of the governor housing. The governor lever is direct connected to the inlet throttle, the lever and connecting link being the only exposed parts.

A high tension magneto is standard ignition equipment, and a fine-toothed adjustable coupling is furnished. An impulse coupling is offered as an extra.

A cast bell housing unites the powerplant with the transmission, enclosing the flywheel and clutch unit. The latter is of the multiple disk type, steel on steel, and runs in a bath of oil supplied automatically from the engine base. The clutch disks are made of sawblade steel. The operating thrust is absorbed by the pinion bearing mounted in the forward end of the transmission, thereby relieving the crankshaft of any thrust duty from that source. Operation of the clutch is by a conveniently located pedal. No means for adjustment of the clutch are provided, but the clutch action is said to be smooth and positive.

The transmission is a spur gear type, with an initial reduction from the clutch shaft to the splined shaft through a pair of coarse pitch spiral bevel gears. Sliding gears on the splined shaft mesh with corresponding gears on the countershaft, and the final reduction is by a 12-tooth pinion meshing with a 72-tooth bull gear. The differential is of the conventional bevel gear type. Two forward speeds, of 2.3 and 3.2 m.p.h., respectively, and a reverse speed of 1.06 m.p.h. are secured at normal engine speed. A selective type of gearshift with guide plate makes possible the selection of the desired speed.

The bull pinion is cut from alloy steel and is heat-treated to stand severe duty. The bull gear is cut from semi-steel. Being symmetrical, it can be reversed on the differential housing, thus presenting a new working face on the teeth. All other gears are cut from carbon steel and oil-hardened, as are all the shafts.

The clutch shaft and one end of the splined shaft are mounted on high duty ball bearings. All other shafts are carried on high duty roller bearings running directly on hardened and ground journals.

All gears, shafts and bearings are enclosed in a dust proof, oil tight, cast iron case, the bottom half of which may be removed for inspection or repairs to the mechanism therein. The gears operate in a bath of heavy steam

cylinder oil. The splined shaft passes through the left-hand side of the case and carries on its outer end a belt pulley of 18 in. diameter and 6-in. face. This supplies power for belt work of practically any nature.

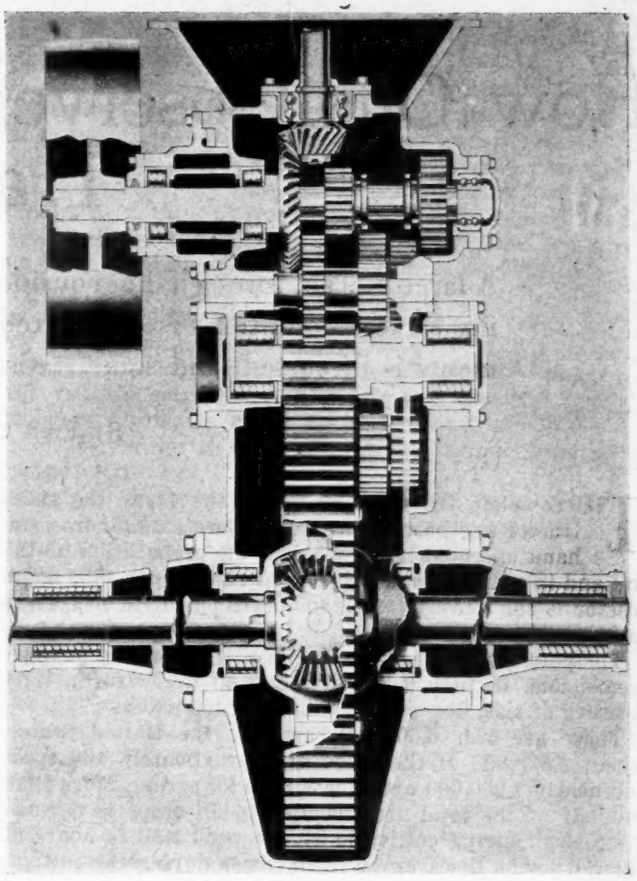
To opposite sides of the transmission case, at the bull-gear center, are bolted cast axle arms in which are carried the wheel shafts and their bearings.

Both front and rear wheels are of rolled and stamped steel construction, fabricated and riveted. Hubs are cast and machined for bearings and shaft fits. The front wheels are carried on drop forged steering knuckles, case hardened and ground. The rear wheels are 45 in. in diameter, have a 12-in. face and are provided with twenty-eight 2 x 2½-in. angle cleats. Special rice field and sand equipments are furnished as extras where required.

The front axle is a malleable iron casting of I-section and is pivoted at the center to permit travel over rough or uneven ground. Radius rods pivoted at the flywheel housing transmit the thrust of the tractor wheels to the front axle. Cushioned connection relieves the operator to a certain extent of undue shocks when negotiating rough or stony ground.

Among other recent improvements has been the replacement of plain bearing front wheels by wheels of the same general design, but fitted with roller bearings. These latter are fully enclosed and protected from dust and dirt. Heavy oil lubricating means are provided and the volume of oil carried in the bearing chamber is said to be ample for several months' constant operation.

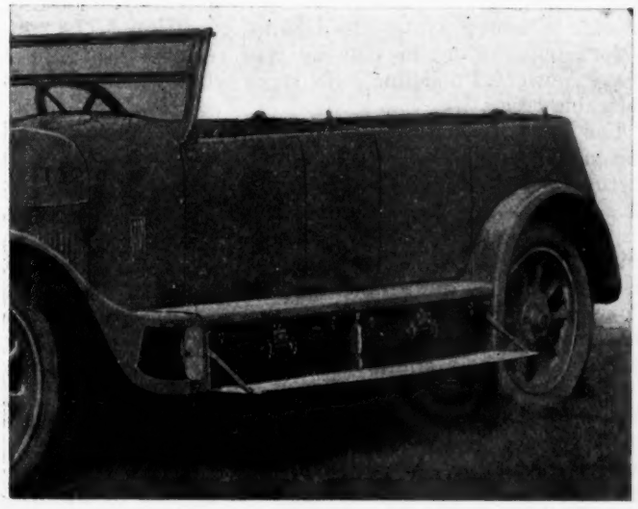
The wheel bearings operate on case-hardened and ground spindles, and side thrust of the wheel is taken on a plain thrust washer, which is inserted between the end of the hub and the hub cap. The thrust bearing surface is thus located where it is protected against dirt and can be thoroughly lubricated.



Halftone view of Samson transmission in section

New Running Board Construction

A GOOD example of sheet metal panelling and the disposal of tool boxes and baggage grips so that they do not form accessories hung on to the car, is presented in a new model designed by the d'Ieteren Body Building Company of Brussels and built on a 6-cylinder Fiat chassis. The two spare wheels are set in a well on the rear panel, the edge of the wheel being flush with the panel.



Running board to carry tool boxes and suit cases

The running boards are made use of to carry tool boxes and suit cases. There are really two running boards, the bottom one being at the usual height and the upper one flush with the floor of the car, the space between the two forming a locker into which specially designed tool boxes and suit cases are fitted. The face of the locker is hinged, thus giving a very neat appearance and allowing the cases to be pulled out as required. This arrangement gives complete protection with great accessibility. The running board locker is very neatly run into the domed front fender, with a battery box built into the base of the fender. The car is fitted with a concealed top.

Des Moines Leads in Home Ownership

THE Division of Building and Housing of the Bureau of Standards has recently completed a chart showing graphically the percentage of home ownership in 1920 in cities of the United States having a population of over 100,000. This chart is based on statistics compiled by the Bureau of Census and also includes a table giving the same values as the chart and in addition the percentage of ownership in the years 1910 and 1900.

In 1920, the lowest percentage of ownership in the country was in New York City, having 1,278,341 homes of which 12.7 per cent were owned by the occupants. At the other end of the list is Des Moines, Iowa, with 31,644 homes of which 51.1 per cent are owned.

How One Observer Views the Garden Tractor

A large market foreseen, but considerable diversity in types to meet varying service conditions is considered necessary. The mounting of implements is discussed, and some statistics regarding production are given.

By Fred C. Ziesenheim

TO complete the motorization of the farm, the small tractor has been evolved to replace single horse and hand operated implements in the preparation of the soil and in planting and cultivating row crops. The small tractor is the newest important development in motorized farm equipment.

The potential market for the small tractor is seemingly tremendous in that it can be used on every farm, irrespective of size, down to the small garden patch.

There are over 6,500,000 farms in the United States. About 2,673,000 of them are of approximately 100 acres and nearly 1,000,000 are of less than 20 acres. More than one-half of the total area devoted to all crops is devoted to crops requiring cultivation. The peak load in hours of horse labor on the average farm comes during the cultivation period and not in plowing and fitting the soil, which is work that the present type of large tractor is designed to do. Large farms devoted to general farming have, in addition to row crops, vegetable gardens and large lawns. Thousands of acres are devoted to specialized farming like that of cotton in the South, onions in the Mississippi Valley, beets in the Middle West and West, and tobacco in the Middle Eastern States.

The market gardener near the cities needs the small tractor to complete the motorization of his farm since he uses a motor truck, instead of horses, to carry his produce to the city markets. Usually, he does not grow his horse feed but purchases it. With motor trucks and good roads, the market gardener is not forced to locate near his market on high priced land, but can locate at a distance where land values are lower. Larger acreage can be purchased, which, through the use of motorized equipment, will give greater returns on the investment. Florists and nurserymen operate under conditions similar to that of the market gardener, and they have been quick to realize the advantages of the small tractor.

Specialized farming and market gardening require considerably less investment and are much more profitable than general farming. Intensive farming will come about as a natural sequence to an increasing population. If the relative increase in population of city over country continues at the same rate as during the past decade—and there is every reason to believe that it will—those remaining on the farm must increase their production of foodstuffs by the greater use of improved power farming machinery.

Markets for the garden tractor in addition to that of the farms are the innumerable greens such as golf courses, parks, cemeteries and large estates where a power lawn mower can be used, since a power lawn mower can be easily attached to the small tractor. There are millions of homes with a lawn and garden patch where the small tractor will lighten the menial task of pushing the lawn mower and the garden cultivator.

The lower operating costs of small tractors, as compared with that of horse-drawn implements, are attributable to factors similar to those which make the large tractor more economical. The tractor makes possible a greater productivity per man hour; there are no operating expenses when the machine is idle, it consumes fuel only when it is working. A machine does not have to be humored on a hot day but will work at full capacity. In cultivating row crops, there is no loss from horses nipping or stepping on plants. A comparison of costs with that of hand-operated implements is evidence that a motor cultivator makes it possible for a man to do more work than when he has to supply the motive power himself. Man power is the most expensive form of power. The greater utility and flexibility of the small tractor is an advantage in that it can do one-horse tasks, hand cultivator work, push a lawn mower, and it can also do a variety of belt work.

A 9-in. plow is the minimum width of moldboard plow that will satisfactorily turn a furrow and plow deep enough to give a good seed bed. A narrower moldboard plow cannot turn under and cover up the crop remains, weeds, loose material or whatever else is on the surface of the ground. The engine power required to pull a 9-in. moldboard plow set at a depth of 5 to 8 in. and at a reasonable rate of speed, will be approximately 5 hp. The tractor must have sufficient weight and wheels wide enough to secure positive traction. The wheels must have sufficient tread and the center of gravity of the tractor must be low enough that in plowing with one wheel in the furrow, the tractor will not tip over readily. Plowing on side hills aggravates the tipping condition. The conditions imposed on the plowing type require that it be a heavy, powerful machine with large wheels set at a considerable tread.

The garden tractor can be divided into plowing and non-plowing types. The functions of a plow are fourfold in that it must turn over the soil to present a clean surface for planting the new crop; it must bury the remains of the previous crop; it must plow sufficiently deep to bring to the surface subsoil that has not lost as much of its plant food as the surface soil, and it must, during the plowing operation, break up and pulverize the soil so that the amount of fitting required in the preparation of the seed bed shall be a minimum.

The tractors which cannot pull a 9-in. moldboard plow should be definitely designed and marketed as a non-plowing type, until such time as some other form of plow is available which will permit narrower furrows. Considerable sales resistance has already been created by unsatisfactory plowing demonstrations. It is difficult enough to

sell farmers any radically new equipment without trying to show them that the machine can do work for which it is manifestly unsuited.

The curved disk type of plow holds possibilities worthy of development in that it can satisfactorily cut and turn over any width of furrow desired. The development and marketing of a satisfactory disk plow would eliminate the non-plowing classification and would greatly increase the utility of the smaller garden tractor.

The plowing type can be divided into the riding and the non-riding types. The riding type has been developed to secure a greater ease and facility in operating the cultivation implements, particularly in eliminating the lifting or carrying of implements in making a turn. To quote a professor of farm engineering: "The day of walking farm machinery is past. Modern power farming equipment sets too severe a pace to require that the operator tramp after the machine. The operator must conserve his energy so that he may give his undivided attention to the implements and the tractor." Implement manufacturers have recently developed riding cultivation equipment which is adaptable to many of the present types of walking garden tractors.

The manner of attaching implements to the tractor depends upon the size and class of the tractor and the type of implements used. In present designs, the implements are attached at the rear of the tractor proper. The center of gravity of the tractor itself is usually forward of the axle center line in order to counteract the torque reaction. The torque reaction, however, assists in keeping the implements imbedded.

A proposed method of attachment for small tractors is to place the cultivation implements in front of the tractor where there is an unrestricted view of the row crop being cultivated, since it is desired to have the implements cultivate close to the plants on each side of the row. With the implements suspended in front, shorter handles can be used, the operator walks nearer the axle center line, the tractor's maneuvering ability is thus increased by lessening the arc through which the handles must be swung for a given change of angular direction. With reference to Fig. 1; for a change in direction of the tractor, the arc on *B* is considerably less than a similar one on *C* when using longer handles.

In the plowing type, implements other than plows are attached so that their center of draft coincides with that of the tractor, the point of attachment being preferably on a vertical line equidistant between the traction wheels and passing through the axle center line but located below it so as to counteract the torque reaction. The engine and transmission assembly, however, usually dictate the location of the draft attachment. The implements are set as closely as possible to the center line of the traction wheels so that the radius from this center line to the implements will be as short as possible, as for instance the radius of the arc *A* in Fig. 1. This decreases the arc of movement of the implements for slight deviations in the direction of the tractor; it permits the use of shorter handles and increases the maneuverability of the tractor so that it is possible to cultivate closer to the plants and to make shorter turns.

In cultivating row crops by straddling, the tractor must have considerable clearance from the ground to avoid pushing over the plants, but the tractor's center of gravity must be kept low to prevent the tractor from becoming top heavy and tipping over easily. Cultivating two or more rows at a time is possible only when the planting has been done by a multiple row seeder with fixed center distances of the rows. A number of these seeders have been developed for use with garden tractors.

The depth at which the implements operate is varied by raising or lowering the point of draft attachment by means of a lever within easy reach of the operator, thus changing the relative height of implements and wheels. Provision is usually made for lifting and holding the implements entirely clear of the ground when turning around at the end of the row.

The center distance of the two traction wheels can usually be adjusted for different treads and provision is made for fitting on extension rims. In one design the extension rims are very heavy and are used to secure additional traction for plowing. The wheels can be mounted on live axles or can be driven through gearing, chain, or belt. Steering may be accomplished in a number of different ways; steering with the handles, operating with independent clutches in each drive wheel, and on the riding type by changing the direction of the caster wheels either through foot bars or a hand operated steering wheel.

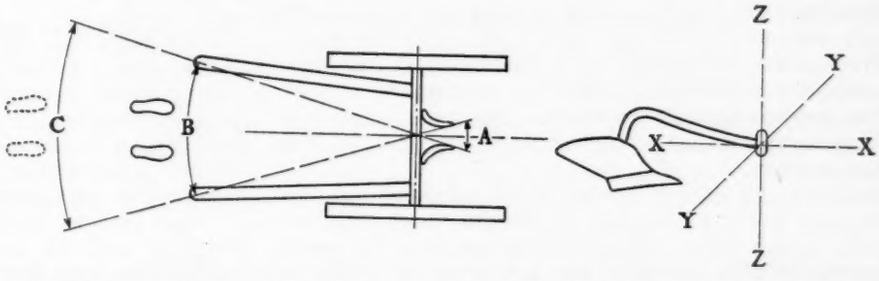


Fig. 1—With implements in front, the operator can walk closer to the axle; the handles are shorter and need be swung through a shorter arc for a change in direction of the tractor. Fig. 2—A garden tractor plow has freedom of movement about the YY and ZZ axes, but is fixed about the XX axis to prevent rolling

Plow Mounting

The center line of draft of a plow is not parallel to the line of movement of the tractor, but is at a slight angle, so that the plow is held into or against the land. The point of attachment should be at the center of tractor draft, as previously mentioned. However, with one traction wheel in the furrow, the location of both tractor and plow is fixed, hence the point of draft attachment must be that compromise which will give the minimum side draft.

Referring to Fig. 2, the plow is fixed so that it cannot turn or roll about the horizontal axis *XX*, *XX* being the direction of plowing. When in the plowing position, the plow sets square and level and it can not roll, but must cut a smooth vertical surface for the land side of the furrow. If the tractor plows with one wheel in the furrow, an adjustment should be provided for changing the plow's vertical setting, so that in plowing the first furrow with both traction wheels level and on the land, the plow can be set to cut a square furrow. On the next round, with one wheel in the furrow, the adjustment can then be changed to bring the plow back into the level position.

The plow has freedom of movement about the horizontal axis *YY*, at right angles to the direction of plowing. The draft attachment floats about a pin in the *YY* axis, the plow thus seeks its own depth, depending upon the height of draw bar attachment. The height can be varied to give different depths of furrow and for removing the plow from

the ground. If it is possible to vary the height of hitch while running, the plow on starting can be set to reach full depth in a very short distance.

The plow has freedom of movement about the vertical axis *ZZ* in order to seek its own width of furrow, depending upon the transverse location of the point of draw bar attachment. This point can be varied along a line parallel to the axle center line, thus giving a means of controlling the width of furrow turned over.

Plowing with one traction wheel in the furrow tips the small tractor considerably; if the wheel on the land strikes an obstruction, the tractor may tip over. In one design this tipping condition is obviated by lowering the wheel in the furrow relative to the other one so that the tractor is maintained level. The wheels can thus secure full width, flat contact with the ground, insuring maximum traction.

There are about twenty firms making garden tractors in the United States; some have been in business for eight years, but the majority have been in but the last four years. According to bulletins of the United States Department of Agriculture, there were sold during 1919 about 3760 tractors of 6 hp. and less rating. In 1920 six firms manufactured 7678 tractors of 8 hp. and less rating, their total value being $2,091,000. The total output of all tractors during 1920 was 203,207 machines with a total value of $193,563,000.

About 15 per cent of the country's total tractor output is exported. The number of gas tractor engines exported slightly exceeds that of the tractor, the total volume of engine exports amounting to $22,000,000 during 1920. The export possibilities of the small tractor and of their engines appears better than for the larger machines, inasmuch as there are practically no European firms making garden tractors.

Practically all garden tractor firms purchase standard implements from established implement manufacturers, but only 28 per cent of them purchase engines for assembly, probably because there are a number of makes of standard implements available, whereas there are only a few engines which can be adapted to the service.

The tremendous development in automobile production during the past 10 years is due to a certain extent to the fact that a large percentage of the cars marketed have been assembled from standard parts. Over 3 per cent of the passenger car firms purchase engines for assembly. The motor truck industry is a more recent development and has made a greater use of standard parts. Of the 139 manufacturers of large tractors 73 per cent purchase engines and other parts. The garden tractor industry will undoubtedly develop along similar lines when suitable engines and parts are available for assembly.

Many of the firms assembling and marketing large tractors may expect to meet with considerable sales resistance for the next few years. These firms have production and sales organizations established, and since implements can be secured from several sources, when suitable engines and parts are available, they will be enabled to market a garden tractor, as it will not require a large investment to enter the business, and the smaller cheaper tractor will not meet with as great a sales resistance.

The small tractor is not strictly a general purpose machine, as it can be designed to meet only a limited class of service. This condition will lead to the development of particular types of small tractors for specific purposes. Many of the small tractors thus developed cannot hope to achieve national distribution, for there will not be a national demand for their particular class of machine. It will follow, then, that small companies will develop tractors suitable for the conditions in their immediate territory, as for instance in the onion growing district of the Mississippi Valley. These firms will not have the resources, nor will they desire, to undertake the development and manufacture of engines, implements and major parts. Their function will consist in assembling standard parts and developing a tractor which is suitable for their conditions. In comparison with the large tractor, the small tractor will require a much smaller investment for development and for the establishment of a limited production and sales organization. Many small firms can thus enter the garden tractor business if the principal burden of development and manufacture is assumed by the parts maker.

The Marketing of Garden Tractors

The retail marketing of garden tractors has usually been through the same channels as that of small cultivation implements. The implement dealer may have a seed and feed, a hardware or a general implement store, or in smaller communities, a combination of all three. Some automotive sales companies have added the garden tractor to their line, which includes passenger cars, trucks, large tractors, and, in some cases, home lighting sets, small gasoline engines and the like. The latter firms can be called power farming equipment dealers and are, from an engine service standpoint, the logical dealers for the garden tractor in the larger centers of distribution. However, the successful application of the garden tractor to the individual requirements of the prospective user requires an intimate practical knowledge of farming implements not possessed by the usual automotive equipment dealer. The garden tractor must be demonstrated and sold on what it can do and not on what the buyer and salesman would like to have it do.

When both manufacturers and dealers have acquired a more thorough and complete knowledge of the capabilities and limitations of garden tractors; have ascertained its particular sphere of usefulness; and have determined to sell them strictly on a performance basis, then the industry will be ready to realize on its potential market.

A New Model of Light Truck

THE Service Motor Truck Co. has added to its line a smaller and lighter speed truck to be known as Model 12. This is of ¾ ton capacity and is considerably smaller than the Model 15 described in AUTOMOTIVE INDUSTRIES issue of Feb. 3, 1921. The latter was originally rated at ¾-1 ton capacity, but has since been strengthened in some respects and fitted with larger tires and is now rated 1¼ tons.

The new model is, however, similar in general design to the older one. It has, for example, the characteristic three-point suspension of the frame made possible by the special design of front axle and cross spring pivoted to the frame at its center. It is equipped with a 3¼ x 4½ in. Midwest engine which develops 32 hp. at 2000 r.p.m., single dry plate clutch, three-speed gearset, tubular propeller shaft with metal universal and slip joint at front and fabric joint at rear, Timken spiral bevel axle with both sets of brake inside the drums, Ross steering gear, pressed steel frame of ⅛ in. stock 5⅞ in. deep with 3 in. flange heavily reinforced at cross member at front end of rear springs. The latter are of semi-elliptic type and take both drive and torque. The gear ratio is 6 1/9 to 1, with 5½ to 1 or 6⅞ to 1 optional. The wheelbase is 128 in. and the tread 56½ in. Chassis weight is given as 2720 lb.

A System for Complete Fuel Gasification

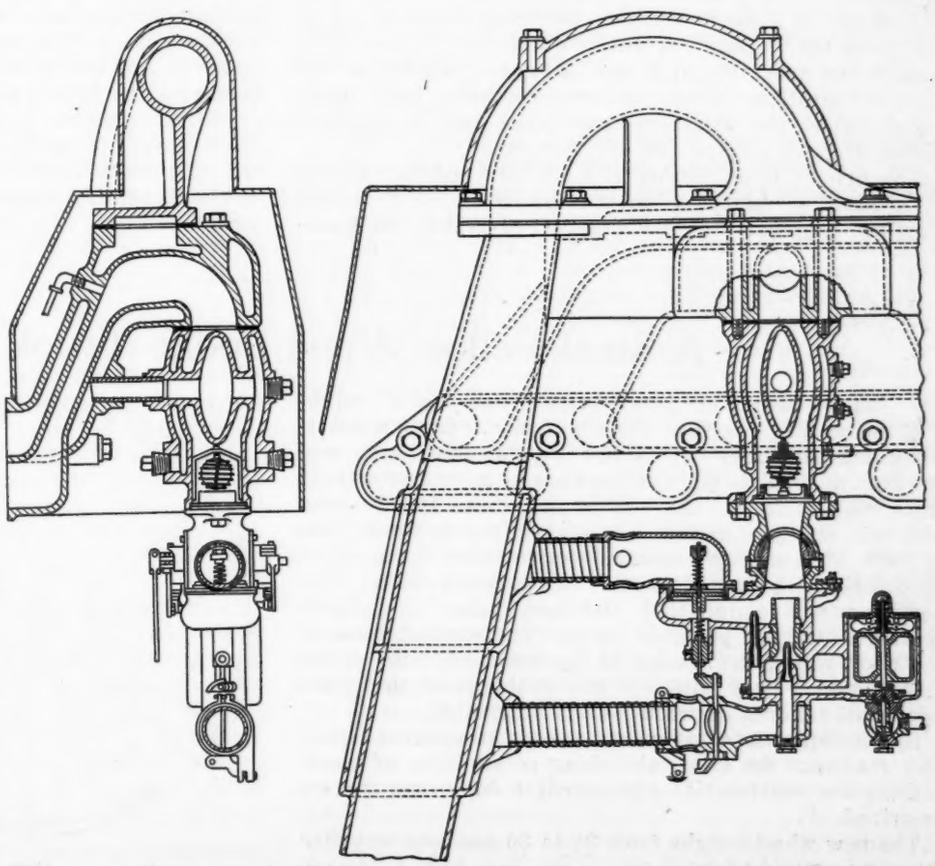
Involves the use of several elements including a device for the mechanical agitation of the mixture, a retort for heating the entire charge above the vaporization temperature of the least volatile elements and means for admixture of small quantities of exhaust gas to prevent detonation.

THE fuel charge preparation or fuel gasifying and mixing system invented by Wm. P. Deppé has been before the public for some years. The system now embodies a number of elements added as a result of experience in its use. We understand that the Deppé system is now furnished on a stock engine of well-known make, if desired.

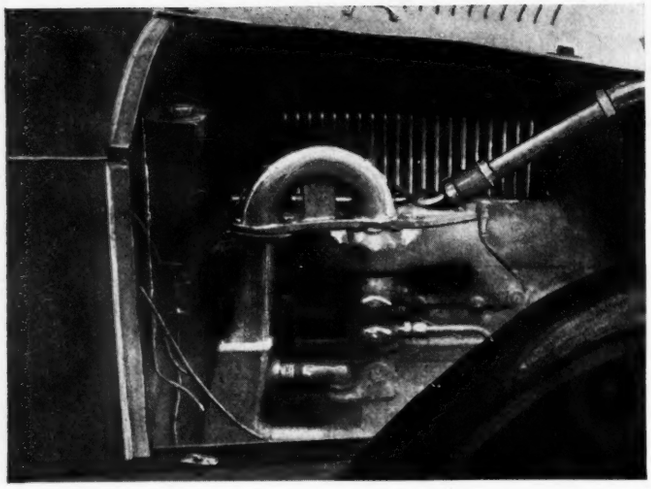
The aim pursued in the system is to so handle the mixture of fuel and air that when it enters the combustion chamber it is in the form of a dry, superheated, homogeneous gas. In order to accomplish this sufficient heat is supplied to raise the entire mixture to a temperature above the boiling temperature of the least volatile fraction of the fuel. In the case of the average American gasoline this is about 425 deg. F. To heat the fuel the liquid particles of the charge are brought into direct contact with surfaces subjected to the exhaust heat. Preignition must be prevented, and as there is not a very wide margin between the volatilization temperature of the least volatile fraction and the ignition temperature of the most easily ignitible fraction, the rate of flame propagation, which affects the tendency to knock, is lowered by the injection of a small amount of burned exhaust gas into the incoming stream of fresh charge.

The apparatus of the Deppé system is inserted between the carbureter and the engine valve ports. In an experimental car built to demonstrate the system in its latest form, use is made of a Stromberg carbureter, and this is also shown in the drawings herewith. Both of the air inlets, the primary and secondary, are connected to air heaters of conventional type cast onto the exhaust pipe, so that only hot air enters the carbureter. The principal part of the system is the charge heater or retort, which is located above the throttle valve. It is quite common to provide a part of the inlet manifold with an exhaust jacket or hot spot, but Deppé goes one step further and makes the riser in the form of an annular passage of comparatively small radial depth, both the inside and outside walls of which are exhaust-heated. The exhaust gases first enter the central heating chamber of elliptical section and then pass to the outer jacket from which they are exhausted to the atmosphere. Deppé argues that when heat is applied to the walls of a cylindrical inlet pipe, owing to the high speed of the charge through the inlet passage and to its relatively low heat conductivity, only the outer layer of the stream will be heated and the fuel particles carried by the central part of the stream will remain unvaporized. With the arrangement used by him, not only is the area of the surface from which heat can be absorbed increased, but the depth to which the heat must penetrate the gas stream from the heating surface is greatly reduced.

The retort is a separate member, connected to the top outlet of the carbureter and the inlet of the combined inlet and exhaust manifold. The manifold also is designed with flat section inlet passages at certain points surrounded by the exhaust passages. At other points the inlet passages are of a fuller form. The variation



Transverse and longitudinal sections of Deppé dry superheated gas system



External view of engine to which Deppé system is fitted

in the form of the section naturally tends toward increased turbulence and to bring all of the charge into contact with the hot walls successively.

One of the causes of deposition of fuel in the passage above the carbureter is the throttle valve. The ordinary butterfly valve when partly closed deflects unvaporized particles in the charge against the wall of the inlet passage, to which they adhere. To overcome this difficulty Deppé has devised a special form of throttle located above the carbureter. This, as shown in section in the illustration, comprises two shutters which move toward the center of the inlet passage from opposite sides so that the opening through the throttle valve is always central.

In the lower part of the retort there is located a revolving agitator made up of a helicoidal structure of copper wire mounted on bearings carried by cross bars in the inlet passage.

In order to prevent knocking of the engine, small quantities of exhaust gas are admitted to the inlet passage at three points—on the side toward the carbureter of the two air heaters, on the exhaust pipe, and at the top of the central heating chamber of the retort. In the wall of the lower air heater chamber there are two small drill holes through the exhaust pipe wall, in the wall of the upper air heater chamber there is one, and in the wall of the retort there are five. The admixture of a certain amount of spent gases with the new charge is said to materially raise the compression at which knocking begins and higher compression ratios than with the ordinary manifold construction are said to be practical without water injection to reduce the rate of pressure increase.

An Electrical Primer

THE design of the Master Electrical Primer has been changed so that there are no live wires under the hood of the car, except when the primer is actually in operation—a period of approximately 7 sec. The switch on the dash now makes electrical contact and at the same time opens the vapor outlet to the manifold, making the operation, it is said, as safe from fire as the horn or ignition. Other refinements have been made which cause the electrical resistance coil to produce within 4 sec. a lighter and dryer vapor.

The primer is an electrically heated vaporizer acting as a kind of auxiliary carbureter designed to assist starting, especially in cold weather. It takes the gasoline direct from the carbureter, vaporizes it by drawing it over a red hot electric coil and discharges the vapor into the manifold.

It is operated by pulling a button on the dashboard. Contact having been made and the needle valve drawn into its seat by the same movement, the suction of the motor is applied to the inner chamber of the primer. Releasing the button automatically breaks connection.

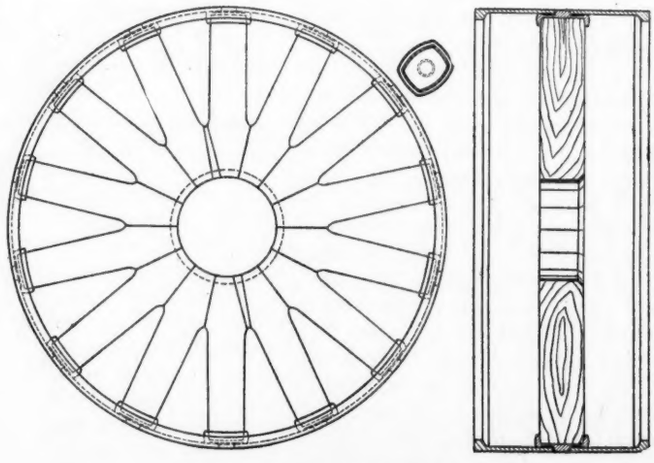
The valve needle is made of monel metal and the resistance coil is made of Nichrome alloy. The heating coil requires 24 amp. The primer is standard equipment on the Franklin, National, Cunningham and some other cars.

A Steel Felloe Wood Spoke Truck Wheel

A NEW design of motor truck wheel which weighs materially less than the conventional wood wheel is being manufactured by Hoopes Bro. & Darlington and has been adopted as standard equipment by one prominent truck manufacturer. As will be seen from the drawing herewith, the wood spokes are retained but no wood felloe is used. The inverted channel section takes the place of an S.A.E. band as well as that of the wood felloe. The manufacturers claim that the spoke has a complete bearing of the end grain on metal. The weakest point of the wood wheel, the seating of the spoke shoulder in the felloe, is done away with. It was at this point that practically all failures of wood wheels originated.

By retaining the wood spokes, the manufacturers assert, they maintain the shock absorbing possibilities of wood, and the new construction adds strength due to the feature described.

The new wheel weighs from 25 to 30 per cent less than the regular wood wheel.



New type truck wheel

Improvements in Gear-box Design

This article discusses gear-box design in detail. It points out some of the usual defects and outlines methods of improvement. The author tells how he would eliminate the bad qualities of the gear box.

By H. F. L. Orcutt*

WHILE it has been demonstrated that accurate gears are necessary for quiet running, it has also been proved that even with quiet-running gears satisfactory results are often quite impossible on account of defective design or workmanship on other components of the box. Certain defects are common to all gear-boxes. They vary in degree, and it is doubtful if any maker of motor cars would say that he is perfectly satisfied with his transmission box. These defects may be roughly summarized as follows: (1) Design; (2) workmanship; (3) material.

Rigidity and Stability of Casings

The design of gear mountings has been the subject of special attention from those who make use of gear-tooth transmission where comparatively high speeds and heavy loads are necessary. It has been found that unless specially designed bearings and adequately stiff shafts are used, gear troubles are common. Undoubtedly, in many designs of motor car gear-boxes the troubles experienced are due largely to lack of rigidity. The box itself is often shaved down to the smallest dimensions. In nearly all cars it is made of aluminum, a metal easily twisted, deflected, expanded or contracted. It is also well known that aluminum has little elasticity and easily "sets" in almost any position into which it may be forced. Further, it has little stability and often changes shape to a degree that is enough to throw bearings out of line. It is doubtful if there is a motor car gear-box made with a casing which has the full theoretical rigidity called for by the loads passing through it.

Size of Shafts

It is really astonishing (especially in some of the so-called "light cars") to note the design of the gear-box shafts. Even in some of the larger cars the tendency is to employ shafts of too small a section. The designer is influenced too much by the desire to reduce weight. Shafts certainly must be large enough so that they will not spring under load. Repeated experience shows that boxes with rigid shafts are quieter than those with small shafts, with gear teeth of the same quality in each case.

Design of Shaft Bearings

The desire to reduce weight and retain simplicity has been carried to the extreme in nearly all gear-boxes. This remark applied especially to one feature of design—that is, the position and number of the shaft bearings. Theoretically, bearings should be so located as to support the shafts directly against the gears taking the load. In practice, with but rare exceptions, gears taking the heaviest loads are in the middle of the shafts and as far removed from the bearings as they can be. Unless the shafts are of large diameter and the box castings rigid, bad running is easily explainable. The alternative to central bearings is a design in which the shafts are as short as possible and of as large diameter as they can be, and run in a rigid casing.

Ball and roller bearings have been the subject of much research and study on the part of makers. They can easily be selected with proper load capacity. Roller bearings have much to commend them. They are not easily deflected by end thrust if shafts are properly mounted, but adequate end-thrust bearings should be provided. There is no reason why properly proportioned plain bearings should not be satisfactory, provided that the material is carefully selected with good wearing qualities, such as steel shafts running in bronze bushes. The designer, too, must foresee possible renewals, and give special attention to lubrication. The tendency to make the pilot bearing of the main shaft run in a bronze bush in the constant-mesh pinion shaft is correct. Makers of ball bearings advocate a more extensive use of ball-thrust bearings, and they give sound advice in respect to mounting their bearings in the casing, so that they will run with no chance of distortion or undesirable end pressures.

Reverse Gears

There seems to be no good reason for mounting reverse gears of the ordinary design on ball bearings, since proper plain bearings meet every requirement. They are also probably cheaper than ball bearings, as no specially close work is called for in making or assembling reverse gearing. In some gear-boxes reverse gears run in constant mesh. If quiet running is desired, such gears must have the same accuracy of tooth, finish and mounting as the so-called constant-mesh gears.

Forms of Shafts

In respect to splined shafts, there are now comparatively few who adhere to the practice of seating gears on the tops of the keys. The development of special hole-grinding machines in which the holes in gears can be finished at a comparatively low cost, and within fine limits, has helped to establish the practice, now common, of mounting the gears on the cylindrical surface between the keys of the splined shaft. Good practice should leave a considerable space between the top of the keys and the bottom of the splines in the gears; hence only rough machining is necessary on the tops of the shaft keys. The bottom cylindrical surfaces and the sides of the keys of splined shafts are now so accurately machined that gears can be made to run just as truly on a four- or six-splined shaft as if they were mounted on accurately ground plain cylindrical shafts.

The assembling of the sliding gears on the main shaft should be done with no fitting work whatever. Splined

*Condensed from a paper read before the Institution of Automobile Engineers.

lay-shafts are also so accurately machined that fixed gears can be assembled on them with a light push fit with no fitting or hand work. When the proper order of machine operations is followed and correct limits are adhered to, the assembling of gears or splined shafts should be an unskilled operation. A suggested order of operations is given under the description of the process of gear-tooth grinding.

Extreme accuracy in finish-machining splined shafts has been a necessary accompaniment to accurate gear-tooth finishing, as a gear with accurate tooth surfaces will not run quietly unless it runs truly. When a gear is mounted on the top of splines it is extremely difficult to finish the bottom of gear key-ways to a degree of accuracy that will insure true running. When the gear is mounted on the cylindrical bottoms of a splined shaft, every mechanical operation necessary to true running can be done at a comparatively low cost, with no hand work and low assembling costs.

Every possible precaution should be taken to fix details of design so as to reduce possible errors of workmanship to the minimum. Following this principle, it would seem that a four-splined shaft is the best form. In the main shaft with four splines, the circular portions between the keys give large wearing surfaces for the sliding gears, and the keys have ample driving strength for the heaviest loads. In the lay-shaft the surfaces give a good seating for the fixed gears.

Tool equipment (especially the expensive broaches) is simplified if both lay-shaft and main shaft have the same diameter and keys. Cheap production costs are easier to maintain if the broaches are finished with small indexing errors and the widths of the broach splines are kept within small limits. As before mentioned, splined shafts should be of as large diameter as possible to assist rigidity. The square shaft is now employed by very few makers on account of the difficulties of mounting a gear accurately on such a shaft.

Design of Gears

The requirements in the design of gears are pretty nearly the same for both sliding and fixed gears. The length of the hub of the sliding gear is often on the small side. The length of the bearing surface should not be much less than the radius of the gear. These gears should slide freely, and have sufficient bearing on the shaft so that the teeth will always mesh in correct alignment. Fixed gears should seat accurately on the lay-shaft and be locked up dead true. To prevent possible deflection it is best to provide for finishing the ends of the hubs on lay-shaft gears true with the holes. If this is done, the gears on the lay-shaft can be mounted with practically the same clearance as those on the main shaft.

The following observations on gears are based on an experience of over eight years, devoted wholly to gear-tooth grinding of transmission-box gears, after they are hardened. They are made with due humility, realizing that the subject of gear-tooth forms is a big one, and much still has to be learned.

With but very few exceptions, makers of gear-boxes blame the gear-teeth for nearly all their transmission troubles. This is largely due to a lack of understanding of the extreme accuracy in gear-tooth forms that is necessary for quiet running, and the natural corollary that a badly mounted gear with perfect teeth cannot run with good tooth contact. Designers and producers do not usually co-operate in taking every possible precaution that gears run dead true under load. They do not realize that the cheapest box is one in which quality above all should be safeguarded by good design, and that accurate machine work is the only cheap method of producing uniform results. Gears carefully mounted running at correct center distance, when quiet show contact over the whole working surface and straight across the teeth.

A 20-deg. pressure angle seems to meet general requirements. The pitch should not be too fine; there should be a sufficient number of teeth in all gears to avoid undercut and interference, and the gear-tooth section should be large enough to carry its load. To secure good wearing qualities, tooth widths should be ample; they are usually too narrow. It seems easier to secure good running qualities with the full depth tooth rather than with the stub tooth.

Without altering ratios to any appreciable extent, the variety of gears in a box could often be reduced. Two or more could be made with the same number of teeth, which would make savings in machine setting, in tooling and in inspection.

The making of so-called "cluster" gears—that is, two or more gears in one forging—or the making of a gear integral with a shaft are both questionable practice. Careful investigation will show that economy and good results are in favor of each gear being a separate forging, as making renewals cheaper and producing less scrap. In the case of a gear integral with a shaft, costs of material and machining are increased, and good heat-treatment is made difficult, since the correct treatment for the gear may be quite different from that required for the shaft.

Workmanship

The workmanship necessary to produce a gear-box at a low cost that will run quietly and be of uniform quality is not commonly understood. Too little attention is given to accurate machine operations, and too much is left for the fitter, the assembler and the tester, while limits of errors and clearances are not properly fixed and inspection is not well organized. A well-designed gear-box should be produced with practically no hand work, and it should be assembled by unskilled labor. Dismantling and reassembling, "running in" of gears or "stoning" teeth is uncalled for, and there should be no extraordinary scrap.

These statements apply to all gear-boxes, either the low-grade article where quiet running is not expected or the high-grade box where quiet, smooth running is demanded.

All mechanical operations on gear-box parts can be carried out to a limit of accuracy that should call for no corrections on the fitter's bench. These limits, as they apply to boxes where good running qualities are expected, will be briefly stated.

Casings

In the casing itself the bores for the main and lay-shaft bearings should not have an alignment error exceeding 0.001 in. in 12 in. The center distances should not have a variation exceeding 0.001 in. Where ball bearings are to be used, the limits of error in the sizes of the holes should be those laid down by the makers of the ball bearings, which, by the way, are usually not adhered to. Scraping out bores should be avoided. Forcing and hammering in bearings easily produces distortion in the soft metal housings, with all sorts of unsatisfactory and expensive results, and a variety of noises that defy classification. It would probably be well to have all casings inspected immediately preceding assembling.

Splined shafts should be finish-machined with no error exceeding 0.001 in. in length, widths and indexing of

keys, or on circular portions. The cylindrical parts can be easily ground to fit correctly in either bushes or ball races. It is hardly credible, but it is true, that many makers seem to have little appreciation of the necessity for careful, accurate centering of splined shafts. They do not seem to know that accurate grinding cannot be done when parts are revolved on inaccurate centers.

The following limits for grinding the holes in gears and on the circular surfaces of splined shafts give satisfactory results. They can be easily adhered to, and with proper inspection no fitting work should be necessary between the gear and the splined shafts.

The maximum clearance between the splines in the gears and the sides of the keys on the shafts depends on the accuracy of the broaching, and the accuracy with which the holes in the gears are ground in relation to the splines. As stated, the variation in size of the keys on shafts in length, thickness and indexing can be kept within 0.001 in.

HOLES IN SLIDING GEARS AND FOR MAIN SHAFTS FROM 1½ IN. TO 2 IN. DIAMETER

	In.
Limit for hole grinding	0.001
From minus 0.001 in. to standard.	
Limit for shaft grinding on circular surfaces	0.001
From minus 0.002 in. to minus 0.003 in.	
These limits give:	
Maximum clearance of	0.003
Minimum clearance of	0.001

HOLES IN FIXED GEARS AND FOR LAY SHAFTS FROM 1½ IN. TO 2 IN. DIAMETER

	In.
Limit for hole grinding	0.001
From minus 0.001 in. to standard.	
Limit for shaft grinding on circular surfaces	0.001
From minus 0.001 in. to minus 0.002 in.	
These limits give:	
Maximum clearance of	0.002
Minimum clearance of	0.000

To avoid fitting work, the maximum width of the shaft keys must be such that there will be no interference on the sides of the keys when the splines in the gears have their maximum errors. To assist in keeping these errors within workable limits, it is suggested that the splines in the gears be finished by a short, specially made broach to be used for finishing only. This broach should remove the smallest possible amount of stock, and the pilot should fit the finish-ground hole in the gear. It should be finish-ground after hardening to standard size, with no errors in indexing or lengths and widths of keys exceeding 0.005 in. This broach can, of course, only be used, as suggested, when the splines in gears are left soft.

The amount of play between the keys on the shafts and the splines in gears can easily be kept to less than 0.001 in. on both main and lay shafts. Alignment of holes in gears in relation to splines can be maintained if the fixture shown in Fig. 1 is used.

Gears

The following notes refer to gears which have their teeth finished after hardening or heat-treating, and which either slide or are fixed on splined shafts, seating on the bottom cylindrical part of the shafts. The bottom of the splines in the gears should clear the top of shaft keys from 0.005 in. to 0.010 in. The top of the shaft key is only rough-turned to coarse limits. The sides of the keys on the shafts are ground to the degree of accuracy already mentioned.

The holes in the gears should be ground true with the splines, using a fixture similar to the one illustrated in Fig. 1, and though no care need be taken to finish the holes true with the teeth, the ends of the hubs of the gears should be finish-ground true with the holes. The variation in diameter of holes should not be more than 0.001 in.

To give good running qualities the mating gears should show a good hand-roll on fixed centers, and the teeth

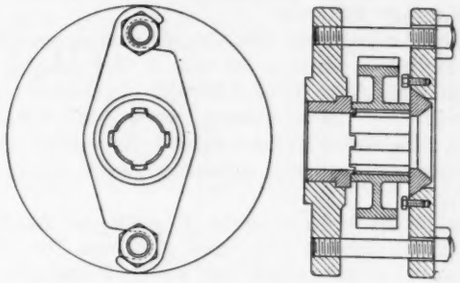


Fig. 1

should show contact over the full working surface from top to bottom of tooth and straight along the full width.

As it has been pretty well demonstrated that complete tooth contact is desirable, it naturally follows that the teeth of gears should be as nearly as possible of correct theoretical form—if an involute tooth, a pure involute—and the finish of the tooth surface should be as smooth as possible. Indexing errors should not exist; they probably do, however, to a certain extent occur in all gears, but unless so small as to be difficult to detect, noisy running will result.

Backlash

The minimum backlash should be such that the gears when under duty will run freely when the box is made with the maximum allowable errors in all its components. Properly mounted gears with correct tooth forms run quietly without regard to backlash as long as they can run freely.

Practicable working backlash limits can vary from a minimum of 0.006 in. to a maximum of 0.010 in. Inspection should be made with mating gears mounted on close-fitting perfectly parallel fixed studs, set at exact center distances, with feelers inserted between the teeth which are in contact.

Eccentricity can be tolerated to a certain extent without bad results, but should be held to fine limits, say a maximum of 0.002 in.

Materials for Castings, Shafts and Gears

Aluminum gear-box castings have one virtue, they are light in weight. But with this metal it is difficult to secure two essentials to good running, namely, stability and rigidity. It is a question whether the gear-box casing of the future will not be made of cast iron, provided that the weight would not be increased too much. Covers and bushings certainly will be made of aluminum. For gears a 5 per cent nickel case-hardening steel has been found most satisfactory. Gears made of this steel, with ample tooth surfaces and properly heat-treated, have been run for years in transmission boxes with no sign of "pitting" and showing only the slightest wear. For splined shafts a 0.15 per cent carbon case-hardening steel meets the requirements.

Future Developments

Will the gearbox of the more or less standard pattern as in the majority of cars, be the gearbox of the future? As at present made, it will probably not survive the exacting demands of the motorist, who is now accustomed to refinements in engine construction, good steering gear and smooth-working back axles. The author believes that it is possible to evolve a much better box than that now commonly made, making use of the principles that

have been demonstrated by years of experience to be good. Broadly speaking, the weaknesses of the usual gearbox are twofold, the design and the workmanship. The design is one in which stability and rigidity are difficult to realize, two qualities which are indispensable to satisfactory running.

The author believes that experiments would demonstrate that in a gearbox of which the case is made of aluminum, success will be difficult. Probably a considerable amount of development work will be necessary before a casing will be evolved in which accurately finished and accurately mounted gears will give good results.

In respect to workmanship, it must be admitted that bad workmanship is the rule and not the exception. This should be corrected for several reasons. In the first place, the costs of production in nearly all boxes would be reduced, as accurate machine work combined with good inspection is very often cheaper than handwork. The quality of most gearboxes would be improved by increased accuracy in mechanical operations.

How many gearbox makers know exactly what they have done to a defective box which finally passes the test? Gears distorted by heat-treatment are "run in." Often the teeth are "stoned." Boxes are mounted in the chassis and given a road test, condemned, dismounted and the gears perhaps "stoned" again or scrapped and replaced. Finally the box passes test. Who can say what has been done to cure the evils or exactly what was the original error? Scrap is made and costs are run up time after time, and the process is repeated, not in every car made, but in many, and in some cases many times on one car.

Gear Box Noises

Uncertain costs are tolerated and quiet running on all speeds is usually given up as a hopeless task. The box finally passes the tester with no exact knowledge of what the original defects were, nor how they were remedied.

Not infrequently a gearbox that is noisy in one chassis runs fairly well or even quietly in another. It seems reasonable to conclude from this fact that defects in other parts of the car made themselves manifest in the gearbox. This is undoubtedly the fact. Gearbox noises have been stopped when an imperfectly balanced engine has been corrected, when couplings have been altered, and when propeller shafts have been increased in size or more firmly supported. If boxes were uniformly produced with all their components made within correctly specified limits, undoubtedly defects in other car units which are now often hidden in irregular gearbox workmanship would be more easily located.

Good design may be defeated by bad workmanship; indifferent design may be moderately successful backed by superior workmanship. Fully satisfactory results are impossible unless designer and producer co-operate, which they rarely do. Details of design should not be settled without consulting those responsible for production. Advice from the production staff should be freely volunteered to the engineering officials. Before a satisfactory box is produced much development work must be done, though the difficulties to be overcome are not formidable when compared with those which have been mastered either in the engine or the axle drive. Probably the standard type of gearbox in its broad principles is worth retaining.

The following are suggested as items which should receive special consideration in experimental or test work, with the object of evolving an improved design of gearbox:

1. The selection of proper material for gears and shafts, with correct specifications of heat-treatment.

2. The design and material of the casing to be such as to give the rigidity and stability necessary to maintain good running conditions.

3. The determination of dimensions of components, including gear teeth, to meet full theoretical requirements of loads and speeds.

4. The correct specification of limits of accuracy of machine operations on all parts.

5. A careful study of the methods of production of parts so that designs lend themselves to machine operations by which low costs, accurate finish and correct mounting are possible.

6. The making of power tests of the box under load at all speeds, independently of chassis tests.

7. Tests in the chassis on the road to determine how running is affected by other units or by the method of mounting.

Gear-Tooth Requirements

It will probably interest those who wish to give the subject of gearbox development special attention, to have as much information as possible respecting gear-tooth requirements. It is quite natural that there should be a wide divergence of opinion respecting a gear-tooth specification for transmission-box gears. Most motor car gears are either finished after heat-treatment with cutters which must necessarily rapidly wear out of truth, or they are hardened after machining and either "run in" or "stoned." Each of these processes results in the production of gears of which the teeth are not of uniform dimensions. It is difficult to form a definite opinion of an article in which the most important dimensions are of an irregular nature.

It is not generally known that gear-tooth forms where quietness, high speed and high duty are called for, must have errors much less than those which are usually allowed in the finest cylindrical grinding. The errors must be so small that they are pretty well impossible to control commercially with any cutting tool except the grinding wheel, whether the teeth be soft or hard. Gear-tooth surfaces, being irregular curves, are difficult to measure, and the final test is made by running under load with theoretically correct mounting.

Gears which are of known uniformity and quiet running should pass the following inspection:

1. Satisfactory hand-roll of mating gears at fixed center-distances.

2. Power tests for noise at high speeds with mating gears accurately mounted at fixed standard center-distances.

3. Backlash so that gears run freely without jamming. Backlash need not be to fine limits when tooth forms are correct.

4. Eccentricity must be within fine limits. It should not be more than 0.002 in. in any gear in the ordinary transmission box.

5. Index errors (by which is meant the pitch spacing of the working faces) must be such that they cannot be detected under ordinary methods of inspection.

6. Tooth shapes must be as near standard as possible, showing on hand-roll or on power test with the mating gear a bearing over the whole working surfaces of the teeth.

7. The finish must be smooth. A roughly finished tooth is not as quiet as a smooth one.

Gears in which the teeth meet the above specifications should run quietly, though the box in which they are mounted may be noisy, but if it is, the symptoms should not be mistaken for the disease.

(To be continued)

A Discussion of Present Methods of Fuel Vaporization

How one engineer views the problems of preparing fuel-air mixtures for combustion prior to admission to the cylinder. A satisfactory system must include means for giving good pulverization and correct mixture proportions and provide separate heating for unvaporized parts of charge.

By N. Julien Thompson

WITHIN the last decade and particularly within the last three years, gasoline has shown greater proportions of high boiling point constituents, and both the initial and final boiling points have been raised. To assist in vaporization two principal methods have been used, one consisting of heat application to the intake-air supply, and the other involving the use of an exhaust heated surface or "hot spot" so arranged that the wet mixture from the carbureter will impinge on the hot surface.

As ordinarily applied neither method gives completely satisfactory results. The principal disadvantage of heating the intake-air to the point required to give a "dry" mixture is the unfavorable effect upon volumetric efficiency and engine power. Unless thorough vaporization is secured, we cannot employ mixtures as lean as desired and still obtain good performance on account of the fact that it is very difficult, if not impossible, to design an inlet manifold for engines having four or more cylinders which will give perfect distribution in the case of wet mixtures. If we try to use such a wet mixture we find that one or more cylinders will give evidence of "popping back" on sudden power demand while the others may fire quite regularly.

According to tests by Kegerreis* on a Knight engine at half load and 1000 r.p.m. in the case of a mixture producing a good compromise between power and economy, namely, 0.07 lb. gasoline per lb. of dry air, an intake-air temperature of about 280 deg. Fahr. was required to give an absolutely dry mixture, but smooth performance could be obtained at points above 160 deg. Fahr. It is extremely doubtful, however, in the case of sudden acceleration under load, that a good cylinder power balance would result at this temperature and mixture ratio. In fact, Kegerreis advocates a warmer mixture to eliminate oil dilution, which indicates that one cylinder at least is receiving a mixture so wet that it is not dried by admixture with the residual exhaust gases from the preceding cycle.

According to Kegerreis the mixture temperature corresponding to an intake-air temperature of 160 deg. Fahr. is approximately 116 deg. Fahr. It seems to the writer that the latter is somewhat low. The method used in ascertaining mixture temperature is not mentioned, but if the measurement was made by insertion of a thermometer in the inlet manifold, as was probably the case, then it is certain that the thermometer reading would be low because the thermometer bulb would be wet in a mixture of such low fuel ratio that, under conditions of equilibrium, a dry vapor would result due to the partial pressure of the fuel at the existing manifold vacuum and temperature. Accordingly, the bulb must furnish a considerable portion of the latent heat of evaporation of the wet film which covers it. In cases where the mixture is dry or practically so, measurement by ordinary thermometer should be quite satisfactory.

In some ways the hot spot of the ordinary type is a less desirable expedient than the heated air-intake. It is easy to regulate the air temperature by thermostat and hot-air stove, but close control of the hot spot temperature with relation to the demand is practically impossible. Moreover, a temperature cannot be used high enough to secure thorough vaporization at all times without producing an unduly large temperature rise in the fuel-air mixture as a whole or without danger of ignition in the manifold which occurs at temperatures approximating 550 deg. Fahr. for present low-test gasolines.

As an atomizing or fuel pulverizing device the carbureter nozzle increases in efficiency as does any other nozzle with the velocity of the liquid passing through it. The liquid velocity and, therefore, the fuel pulverization, other things being equal, increases according to the suction applied to the nozzle, or according to throttle opening and engine speed. The greatest amount of heat from the exhaust is available at high speed under full load, or at a time when it is needed the least. To offset this there are, however, two favorable factors: The lower vapor velocity at low engine speeds, which allows more time for vaporization to take place, and, under light loads with a throttled engine, the increased manifold vacuum, the effect of which is virtually equivalent to an increased fuel volatility.

It is helpful to cut down or increase the supply of exhaust heat to the hot spot by means of a valve, the position of which is changed with speed or throttle opening or both, and engines have been designed embodying these features. However, the present-day car user demands flexibility above all things, and, since he gets it, speed and load are so quickly changed under driving conditions that the temperature of the hot spot must show considerable lag behind the exhaust heat valve variations. Accordingly it is desirable to make the hot spot of good conducting metal and as thin as is allowable. A disturbing factor is the formation of sooty carbon on the exhaust side of the surface, thus decreasing the thermal conductivity and hence the efficacy of the device. Carbon in the exhaust system is proof that combustion has not been completed in the cylinders.

While pointing out the limitations of the two methods of vaporization, the writer certainly does not wish to

*AUTOMOTIVE INDUSTRIES, Sept. 29, 1920, page 610.

give the impression that they are to be condemned. On the other hand, operation without these features would have been impossible on recent commercial gasolines. Still, we must look for a decrease in the supply of motor gasoline or a lowering of its grade, and in the latter case, which is the more likely in the near future, it will become more and more difficult to obtain good economy and satisfactory engine performance without marked decreases in power output.

Realizing the failure of the hot spot and heated air-intake methods to fully cope with the vaporization problem, the writer, due to intense personal interest, but not on account of any connection with the automotive industry, studied the various factors involved in the use of low grade gasoline and kerosene. This study and the conclusions drawn therefrom have since been substantiated by the invaluable work of Wilson and Barnard.*

It is desired to thoroughly vaporize the fuel after leaving the carbureter mixed with the requisite proportion of air, the whole assuming a temperature at which manifold condensation cannot occur. Using the figures given by Wilson and Barnard for a typical gasoline of spec. gravity 0.743 (60 deg. Baumé) and having a distillation range from 140 deg. Fahr. to 412 deg. Fahr., it is found that once vaporization is secured no condensation can take place at temperatures in excess of the following:

Vacuum, lbs. per sq. in.	15:1 Air to Gas Ratio, deg. Fahr.	12:1 Air to Gas Ratio, deg. Fahr.
0.0	95	104
3.0	86	94
4.5	81	89
6.0	76	83
7.5	70	77

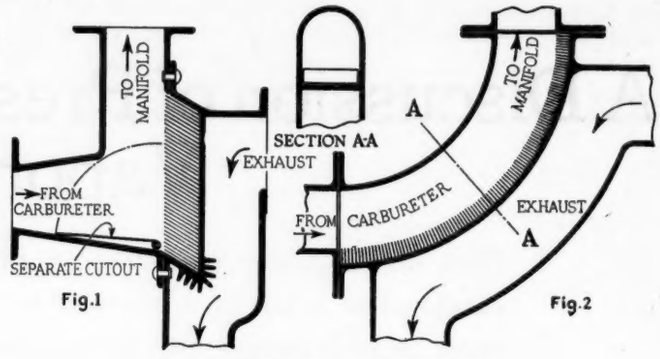
With these figures and those of Kegerreis we are at once able to draw a comparison between what might be obtained and what actually is obtained when air heating is used to effect vaporization. At a 15 to 1 ratio and assuming a manifold vacuum of at least 2 lb. per sq. inch (for the engine used by Kegerreis) at the prevailing conditions of speed and load, a temperature at 90 deg. Fahr. is required to maintain a dry mixture once secured, but an air supply at 280 deg. Fahr. resulting in a mixture at about 220 deg. Fahr. is necessary to produce a true vapor. By calculation it is found that in the latter case the weight is about 23.5 per cent less for a given charge than in the former. Using the wet mixture figure of 116 deg. Fahr., at which it is claimed smooth operation can be obtained, there is still a decrease in weight of approximately 5 per cent, although it is realized that the temperature of a dry mixture can be lowered to the point where a considerable portion becomes condensed and apparently smooth performance be secured on account of the very fine state of division of fuel particles so produced. The gasolines used by Kegerreis and by Wilson and Barnard are not the same, but a study of their characteristics as given shows that for the purposes of this argument the difference is inconsiderable.

The following conclusions were reached with respect to the production of a practically perfect vapor from gasoline-air mixtures:

1—Raising the temperature of the intake-air on account of the low thermal conductivity and specific heat of the latter, results in a large decrease in volumetric efficiency. The time for heat interchange is altogether too short, but cannot be materially increased without serious complication.

2—The "hot spot," which is also correct in principle, is subject to certain practical limitations, viz.: it is impossible to closely control its temperature; it is exceedingly difficult at high vapor velocities of wide variation to use a hot area sufficiently large for the purpose set forth without producing an unduly great increase in the heat of the mixture over the majority of the operating range.

*Journal of Industrial and Engineering Chemistry, Oct., 1921, p. 908.



Two suggested forms of vaporizers

In spite of the inadequacy of the usual "hot spot" against which the mixture is directed, it is believed that an exhaust heated metal surface will prove the most satisfactory considering the degree and quantity of heat required. However, it is recognized that if a sufficiently large hot area is employed, provision must be made to vaporize the fuel separately or to protect the vapor formed as a result of carburetion from unnecessary rise in temperature. Separate volatilization of the gasoline with subsequent admixture with air involves changes in carbureter design as well as difficulty in starting the engine. Accordingly, means were studied by which use might be made of all the available heat, if necessary, and still leave the carbureted vapor in a cool condition.

From this study it was concluded that a satisfactory system must comprise the following sequence: Efficient atomization of the fuel and admixture with the correct proportion of air by the carbureter. separation of the remaining liquid particles from the vapor stream, directing these liquid particles against an exhaust heated surface where they are volatilized, conducting the resulting gas back to the original vapor stream, the system being so arranged that the final aggregate vapor mixture temperature produced will exceed as little as possible the temperature at which condensation takes place. Means must be provided to facilitate starting with a cold engine. Furthermore, for use to the best advantage, control of the mixture temperature is advisable. This can be obtained by a thermostat placed in the final vapor stream and operating a cold air valve located between the carbureter and an air-heating stove.

Fig. 1 illustrates a device designed to act according to the scheme outlined above. The fine parallel lines represent a nest of thin metal plates or vanes. The liquid particles are thrown on to these and conducted to the heating surface. The plates are sufficiently close together so that the original vapor is protected from the heat, but still not close enough to induce capillary action. To provide for quick starting with a cold engine, the valve or "separator cutout" is designed to be raised by dash control to a vertical position, allowing liquid fuel to pass the separator plates. This device might be used with fuels of lower volatility than present-day gasoline, maintaining a very hot exhaust-heated surface.

In Fig. 2 is depicted a vaporizer which is probably more suitable for use in connection with existing motor

fuels. Since the hot surface is closer to the mixture conduit, quick response will be made to changing throttle conditions. Moreover, the mixture is deflected more gradually from a rectilinear path, thus depositing the liquid particles over a large proportion of the heating surface. This device does not permit as easy starting from a cold motor as may be desired. However, this difficulty is easily overcome in many ways, e.g., by a by-pass conduit provided with a suitable valve, independent cylinder priming, or an electric resistance heating coil in the path of the mixture as it leaves the carbureter.

It is possible to design a great number of devices which on casual inspection are not all similar, but which really may embody the same principle. For example, liquid fuel may be thrown out by a bend in the conduit, by a baffle or series of baffles, by centrifugal force, and so on; and the vapor stream may be protected from the heating medium by vanes, baffles, screens and by separated ducts, channels or chambers. Yet each one to be successful must give efficient separation of the liquid, good protection of original vapor from excessive heat rise and effective and quick vaporization of liquid fuel so as to respond almost instantly to changing throttle opening.

Electric Standards Being Formulated

THE Lighting Division of the Society of Automotive Engineers Standards Committee is considering a proposal that the tolerances for the diameters of the standard bases and sockets for headlamp bulbs should be reduced, as it is stated that they are wider than necessary and permit sufficient play to cause considerable variation in the position of the filament and consequently the illumination characteristics of the lamps. It is felt that although narrower limits are not essential, they would improve the specifications and not introduce undue restriction on manufacturers of the parts.

Breaker Contacts

At a recent meeting of the Electrical Equipment Division it was decided to consider the standardization of the hexagon stock used in making timer-distributor contact breakers. It was stated that there is considerable variation in the size of stock for mounting the breaker points, necessitating a number of sizes of wrench for adjusting this part on the several types of ignition apparatus.

It was suggested that ¼-in. hexagon stock be considered for adoption as standard, and that if this is not feasible, the standard should embody a range of two or possibly three sizes, such as 3/16, ¼ and 5/16-in. It was argued also that the proposed standard should embody the height of the hexagon and the size and length of the thread. Information on present practice is to be obtained for consideration at the next meeting of the Division.

It was reported that a thorough investigation of the patent situation in connection with spark plug hoods had been made and that it was claimed that a number of patents in the aggregate cover any practical form of construction. It was therefore decided to discontinue consideration of the standardization of spark plug hoods.

Storage Batteries

It has been felt that the Standards Committee could be of service to the storage battery and associated industries in connection with the recent development of a molded hard rubber storage battery container. As the molds and equipment for making these containers are very expensive, it seems that the logical procedure for the battery, automobile and hard rubber manufacturers is to get together and adopt standards relating to the rubber container, before too much money shall have been spent on mold and machine equipment.

A further object of the standardization proposed would be perhaps to guide the automobile builders in adapting their battery compartments to this more compact type of battery, so that they and their customers will not be handicapped in the way they have been handicapped in the past when an automobile was put out with a battery compartment of such dimensions as to preclude the use, for either original equipment or renewal, of any but one special make and type of battery.

Another point is the need of a name to distinguish the single compartment container from the present case and jar. It is stated that the word "container" is not desirable on account of its similarity to the word "retainer" and because it has been used in a general sense already. The words "case," "box," "tray" and "jar" are already used as names of battery parts.

It was decided to take up the standardization of magnet wire for automotive apparatus, including both fabric and enamel insulation types.

Electrical Equipment Nomenclature

The use of the term "timer-distributor" was thoroughly discussed at the Standards Committee Meeting held on May 24, 1921, and several negative votes were cast against the adoption of the term by members of the Society in the July, 1921, Society Letter Ballot on the adoption of standards. The comments submitted were discussed at the meeting of the Electrical Equipment Division and the opinion was expressed that "timer-distributor" is the most suitable term and should be retained. Chairman Libby stated that he had noticed that the term is used in the majority of cases in technical references and in about 80 per cent of the patent investigations that he has conducted, and that these sources indicate that the term is of long standing. It was therefore decided to recommend no change in the present nomenclature.

Generator Mountings

T. L. Lee, chairman of the Generator and Starting Motor Subdivision, reported that, after studying the suggestion to omit the dimensions for the pilot specified in the present standard for generator flange mountings, he did not consider it advisable to do so. The discussion indicated that although one large manufacturer of electrical equipment, which suggested omitting the pilot dimensions, does not use pilots on its equipment, a large number of other manufacturers do. The advantage of retaining the pilot was pointed out and the statement that when a customer orders equipment on which no pilot is desired, it is easy to machine off the pilot.

A suggestion in reference to lengthening the threaded-end of the shaft of the generator bracket molding was discussed at length and the decision reached that a change is not desirable owing to the limited space provided for the couplings, particularly in present engine designs.

The Subdivision was assigned the work of standardizing a strap mounting for generators. This had been suggested by an automobile builder, it being stated that a standard should specify a generator barrel diameter of a sufficient distance along the barrel to give a stable mounting, with tolerances of possibly plus or minus 0.002 in. applying to the diameter. It was also said that a standard should establish certain limits for the concentricity between finished part of barrel and the armature shaft.

A New Crankshaft Balancing Machine

Obviates the need for a preliminary static balance and permits of quickly determining the magnitudes and proper angular positions of correcting moments required to insure accurate dynamic balance.

By P. M. Heldt

IN balancing crankshafts and similar revolving parts by the methods in common use so far, a static balance is first obtained by placing the part on balancing ways and removing weight from the heavy side until it will remain in any position in which it is placed. After this static balance has been obtained there usually remains an unbalanced couple, that is, the part is heavy on one side at one end and on the opposite side at the other end. The axial plane and magnitude of the couple are then determined by means of a rotating balance machine. This couple is eliminated by adding or removing weight in two transverse planes, usually at or near the ends of the revolving part. The static balance could also have been obtained by removing weight in one or the other of these transverse planes, and, therefore, the two operations of statically and dynamically balancing a crankshaft or other revolving part can be combined in a single operation.

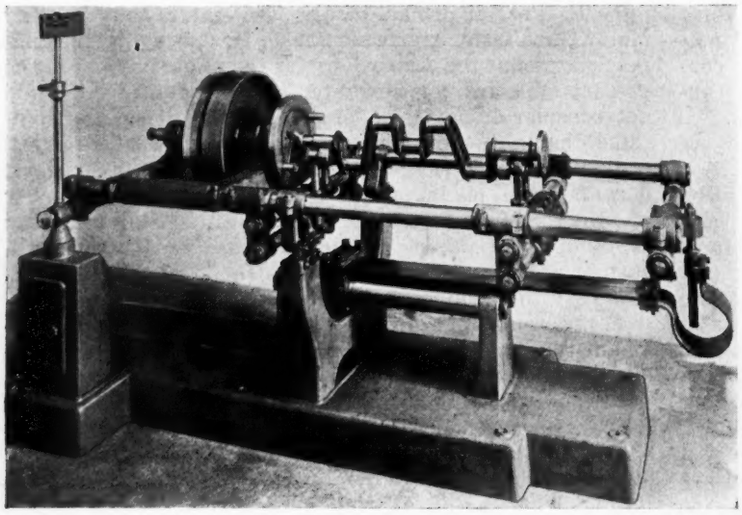
A balancing machine which permits of doing away with the necessity for a preliminary static balancing has been developed by the Precision Balancing Machine Co. The machine was invented by Dr. B. L. Newkirk, formerly of the Engineering Department of the University of Minnesota, and was experimentally developed by F. McDonough, president, and Amos F. Moyer, chief engineer, of the Precision Balancing Machine Co. As shown by the illustrations herewith, it consists of a bed on which is supported, by means of two thin vertical spring steel blades, a tubular framework upon which the body to be balanced can be supported and revolved. The framework is steadied by a horizontal cantilever spring with a scroll at its end.

The stiffness of this spring can be changed by varying its effective length, and there is also a micrometer adjustment between the scroll spring and the outer end of the tubular frame. It will be noted that one end of the crankshaft is located directly over the "knife edge" bearing support of the frame, so any vibration induced in the frame is due to the unbalance at the opposite end.

A special type of headstock is carried by the frame, as are adjustable rollers for supporting the parts to be balanced. If an unbalanced part is placed on the machine and is then rotated, it will set the freely mounted frame in vibration. This frame with any particular part has a natural period of vibration, and if the part is rotated at such a speed that the speed of rotation corresponds to the natural period of the frame with work, even a slight degree of unbalance will cause a comparatively heavy vibration. This speed is referred to as the critical speed. The method of operating the machine is as follows:

Operation of Machine

The crankshaft or other part to be balanced is placed upon the supporting rollers and lightly clamped in a chuck on the face plate. Coupled to the work are the revolving parts of the headstock, which are perfectly balanced. To take a reading, the system is set in rotation at a speed slightly above the natural period or critical speed of the



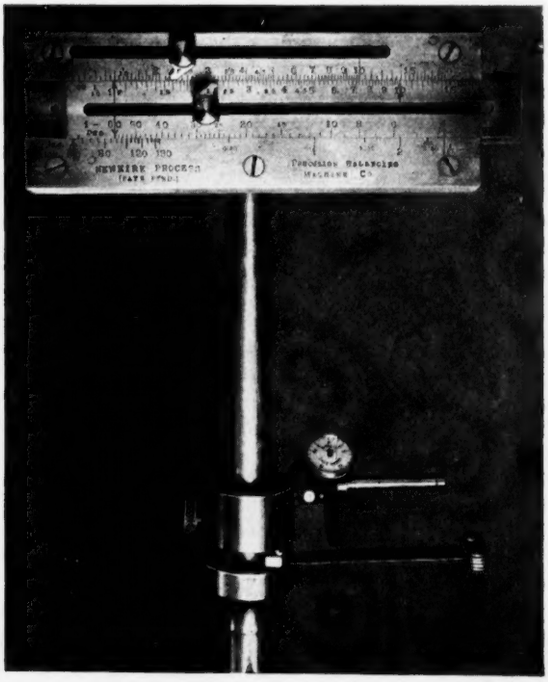


Fig. 1—(Above)—General view of Precision balancing machine. Fig. 2—(On Right)—Instrument column with slide rule for quickly determining angular position of unbalanced moment from negative magnitudes of first and second indications of dial indicator

frame and allowed to slow down by the slight friction of the ball bearings. As the critical speed of the frame is passed through, there will occur a maximum oscillation which is directly proportional to the unbalanced moment of the overhanging end of the part. The maximum amplitude of vibration is read off on a dial mounted on a standard or instrument column, to which connection is made from the vibrating frame by a steel rod or wire. It may be pointed out here that, except when making tests, the frame is held from vibrating by means of a taper plug on this standard, which enters a corresponding hole in the frame. It has been found that the best results are obtained with a critical speed of 100-110 r.p.m. and the cantilever spring is adjusted to give this critical speed. It is quite possible to impart to the revolving system a speed somewhat higher than this by spinning it by hand, but if desired, the headstock can be revolved by a small electric motor.

Magnitude of Unbalanced Moment

From the maximum amplitude of vibration as read off from the indicator and a calibration factor separately determined, the unbalanced moment in ounce-inches can be directly ascertained. A corrective moment is then applied to the rotating system in the form of a sliding weight on the headstock, which is moved out radially from the axis and clamped in position at such a distance from the axis as to give the necessary moment.

To obtain the angular position at which this correction is required, the correcting moment is arbitrarily applied on the headstock at an assumed angle, and the system is again speeded up and allowed to slow down through the critical speed as before. The maximum amplitude this time will differ from that obtained the first time, the ratio of the two readings being dependent upon the angle between the point of arbitrary application and the point required. The trigonometric value of this ratio is

$$R = 2 \cos \tfrac{1}{2} (180° - A),$$

where A is the required angle. This function plotted on a polar diagram is shown in Fig. 3, which may be used for ascertaining the angle after obtaining the ratio of the second amplitude to the first. A scale corresponding to Fig. 3 is also built into a special slide rule mounted on the instrument column. Scales are also here provided for employing the calibration factor and taking ratios, so that the operator is relieved of all computation. The angle ascertained is set off on the headstock dial and the results are checked by another run.

After the magnitude of the unbalanced moment and its angular position have been determined for one end of the revolving part, the latter is turned end for end on the roller supports and a fresh determination is made.

Limits of Precision

For revolving bodies 18 in. or more in length a limit of error of 0.2 oz.-in. is guaranteed, as regards both static and dynamic balance. In the case of short bodies, such as flywheels, the limiting error on static balance is the same, while that on dynamic balance is 1 oz.-in. The degree of accuracy represented by these figures is said to materially exceed commercal requirements. How sensitive the machine is is shown by the fact that although the vibrating frame with work weighs upward of 500 lbs., it can be set to vibrating perceptibly by simply blowing against the free end with the breath. To minimize the friction, the revolving parts are carried on ball bearings.

Parts up to 750 lb. in weight can be handled in the machine, and it is figured that the limit of error in the results obtainable would be sufficiently low for all parts weighing not less than 15 lb., so this constitutes the lower

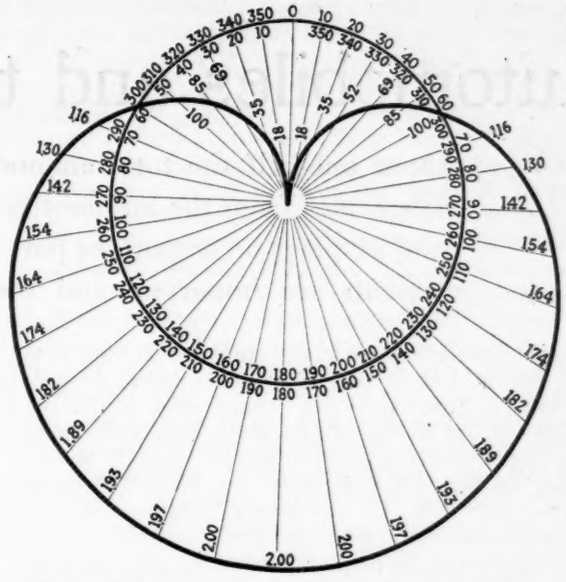


Fig. 3—Effect of the application of the so-called correcting moment according to its angular position relative to the unbalanced moment

limit of the machine's capacity. The machine is universally adjustable for any size of work up to 24 in. swing and 32 in. between bearings.

As regards the time required to balance a part, determinations are made at the rate of ten to fifteen per hour, depending on the accuracy of the result desired. Marks placed on the work direct the operation of drilling which may be done at any time later, and should not require rechecking of the result.

The machine here illustrated was described and demonstrated at the S.A.E. tractor meeting in Minneapolis recently. After outlining the principles underlying the construction and operation of the machine, Mr. Moyer took occasion to correct a misconception regarding the general subject of balance. This is the idea that a body may be in balance at one speed and out of balance at another. This conception has arisen from the evidence that objectionable vibration may occur at one speed, but not at some other speed. In such instances the speed of objectionable vibration is only a "critical speed," or a speed where the elastic period of the supporting means is in synchronism with the speed of rotation. At other speeds the unbalance producing vibratory forces is still effective, but does not meet with a periodic elastic response. In other instances, vibratory forces may be absorbed by the structure up to a certain limit, and when this is exceeded as the result of an increase in speed, violent knocking or rattling may result.

AN investigation regarding the preparation and uses of metallic zirconium and its salts has been conducted by the Bureau of Mines and the results have recently been made public.

Coherent white zirconium metal, on account of its acid-resisting properties, has been suggested as a substitute for platinum in certain cases. Crucibles prepared from zirconium oxide were proved in the experiments of the Bureau of Mines to be superior for high temperature work to any crucibles procured on the market.

The results of the investigations of the Bureau of Mines are available in Bulletin 186, "Investigations of zirconium with especial reference to the metal and oxide," by J. W. Marden and M. N. Rich, which is distributed by the Superintendent of Documents, Washington.

Automobiles and the Asbestos Industry

About one-half the total amount of money expended for asbestos materials comes from the automotive manufacturer and car user. Use of this product plays an important part in the make-up of many cars. Chemical elements are important and the different qualities mined deserve study.

FROM time immemorial men have known about asbestos, but in the days when it was looked upon as a great curiosity there was probably little thought in the minds of the men of ancient times that some day it would become a factor in the industrial life of the world. Charlemagne, for instance, in all his wisdom and with all his vision, would probably have laughed to scorn the man who told him that the material would some day become an important part of a terrifying machine that ran without any visible power. Charlemagne knew of asbestos as a sort of plaything with which to entertain guests, for he had a table cloth made from it and seemed to enjoy the effect upon his visitors when he threw it into the fire to cleanse it.

And so on down through the ages until something like a half a century ago, asbestos was looked upon as something which had no real purpose in the universal scheme of things.

About 1870, however, it was realized that commercial uses could be made of asbestos. When that fact was finally discovered new uses sprang up almost as fast as the material could be mined, and 40 years later, 1910, hundreds of ways of using it had developed. To-day asbestos mining and manufacturing processes have become so perfected that there are many large mines all over the world, the largest, however, being in Canada. And automobile manufacturers and users spend about one-half the total amount expended for this material.

First Use As Brake Lining

The principal, and probably the first, use to which asbestos was put in the automobile was in the brake lining. This is far from being the only use, however, as every manufacturer knows. The idea of using asbestos in this connection was probably first thought of by a British engineer named Hutchings who conceived its use in 1896. The idea got little further at that time, however, and until 1905 it reposed in the British Patent Gazette, unhonored and unsung. Whether or not C. W. Raymond of Worcester, Mass., who in 1905 was manufacturing parts for automobiles, came across the idea in the British Patent Gazette is not known. At any rate he wrote to a leading asbestos manufacturer about that time and explained that he was having trouble in making a suitable brake lining for automobiles. He had tried mohair, leather and various other materials, but he declared that under high friction caused by weight and speed, these materials would burn and they were not giving satisfaction. The old-fashioned "metal-to-metal" brake had proven unsatisfactory, and some substitute was necessary. He asked the asbestos manufacturer for samples of his product and his opinion as to whether or not the material would prove satisfactory in that capacity. The samples were sent to Mr. Raymond and in a short time patents were taken out and asbestos brake lining, made from a combination of woven asbestos and brass wire, began to be pretty generally used on motor cars. A recent estimate of the amount of asbestos used for this purpose alone placed the figure at 70,000,000 ft. a year. Of this figure it was estimated that 15,000,000 ft. would be used in new cars, and the remaining 55,000,000 ft. in the replacement market.

As time went on new uses for asbestos in the automobile were brought out, and in the present highly developed motor car there are a dozen or more parts in which asbestos may be used. Perhaps next to brake linings asbestos is used more for clutch facings than in any other part of the car. There are two types of clutch facings, one the woven type, similar to the material used in brake linings, and endless rings are stamped from layers of cloth. The other is the moulded type, which is made from a board of asbestos. Other uses include packing of woven asbestos for gaskets; copper asbestos for manifold, cylinder heads, spark plug washers, etc.; wicks for exhaust pipes; paper and board asbestos around the exhaust pipe for heat insulation; pads for blanketing the radiator; sheets inside the hood and many other uses. Different manufacturers, of course, use the material in different ways, and new devices, some of them novelties, are often placed upon the market.

Most of the asbestos in use in the United States is imported from Canada. True, there are large deposits of serpentine rock, which contains the veins of asbestos, in this country as well as other parts of the world, but development of the Canadian mines has thus far produced the best material. About 75 per cent of the world's supply comes from the dominion. One large mine in Canada, in the province of Quebec, near Thetford, stretches over an area of 500 acres, and about 100 acres are now being worked. Should the remaining 400 acres of this mine be capable of producing the same quality and quantity of asbestos as the first 100 there seems no possibility of a shortage for some time to come. The same company also has a large mine in Arizona, as have other companies and deposits of asbestos are to be found in Vermont. Asbestos is also found in Russia and Rhodesia in large quantities.

Chrysotile, the Commercial Product

There are also large deposits in Corsica and Italy which have not been worked to any considerable extent. The variety from these countries, in part at least, is somewhat different from that produced elsewhere. This product is known as amphibole, and has little or no commercial value. The asbestos most in use commercially is known as chrysotile. Amphibole is to be found in many sections of the United States in large quantities, but the lack of strength of its fibers prevents it being used in a commercial way. Attempts have recently been made to produce a molded material from amphibole, but its success is not assured.

The open pit, or quarry method, is the one most in use in mining asbestos. In order to get one ton of asbestos fibre it is estimated that it is necessary to blast,

mine, convey and put through the mills something like 15 tons of serpentine rock. The asbestos fiber lies in veins in the rock, and after dislodging the rock from its resting place by blasting, men known as "cobbers" go into the pits, where, with a small hammer, they break away the pieces of rock from the long fiber asbestos. This material is then carried to buildings, where it is further cleaned and sorted.

It is impossible, of course, to get all the asbestos by this method, and the balance of the rock that has been loosened by the blast is loaded in cars and conveyed to the mills. Here it is placed in immense crushers which reduce the rock to pieces about the size of a man's fist. It is dried and again crushed into very small particles, after which it is placed on a sieve where the asbestos fiber is separated from the rock. This process, in itself is interesting. The sieve, which is constantly shaking, forces the heavy rock to the bottom, while above it are great tubes through which an air suction system works. This suction draws the asbestos fiber into the tubes and it is here that it makes its final departure from the rock in which it has been embedded for centuries. The fiber is then divided into three grades, one called long spinning fiber which is used for the manufacture of textiles, and which is probably used together with crude asbestos to a greater extent than any other grade in the automotive industry; a medium length which is used in making asbestos paper, compressed sheet packings and many other materials. The third is a grade commonly used for the manufacture of asbestos cements, etc. The material is then ready to be packed in bags and shipped away to factories, where it is made into the various things that are proving exceedingly useful in industry. Most of these factories are in the United States, as very few finished articles are imported. The United States is the largest importer of asbestos, as well as the country manufacturing processes used for making the most articles from the material.

Principal Uses to Which Asbestos is Put in the Automobile

Brake linings.
Clutch facings.
Fuse parts.
Cylinder head gasket packings.
Manifold gasket packings.
Spark plug gasket packings.
Exhaust pipe coverings.
Insulation tape.
Sound deadening sheets between muffler shells.

To describe the various manufacturing processes used for making various articles would require considerable space, for there is a difference in the process for each article. Even to describe them for the various parts of an automobile would require several pages. In the main, however, these processes are divided into three classes. The first is the carding, spinning and weaving of the fiber into various textile forms from which brake linings and packings are made. This process is similar to that employed in the wool and cotton industries. The second is the process of making asbestos paper or felt, and methods similar to ones used in paper mills are in operation. This product is used for roofings, pipe coverings and other insulations. The last main division includes the making of asbestos shingles and boards, a number of packings, electrical insulating materials and brake blocks of high friction value. From all these processes parts are made for the automobile.

As to what is the best material for the various parts used in a motor car, there has been some discussion. Various tests have been made with different materials, and with different grades, and a divergence of opinion has been the result to some extent. The consequence has been that practically every car manufacturer has his own idea on the subject and buys his asbestos accordingly. Incidentally, asbestos manufacturers also seem to have formulated opinions of their own along this line, and make their products accordingly. The Bureau of Standards has recently been conducting tests with asbestos as it is used in the automobile, particularly with regard to brake linings. It is known that brake linings having a high coefficient of friction are the ones which will stop a car or truck in the shortest distance, but the material of a high coefficient of friction does not possess the lasting and wearing qualities of that with a lower coefficient. Incidentally, the latter will not serve as efficiently. Naturally the Bureau has been working to strike a happy medium and set a standard for this product. Asbestos manufacturers have apparently realized the value of such tests and in some cases they have adopted the method the Bureau is using and conducting their own tests along the same line and making their product conform to the standards they themselves find to be the best for the particular material or product they manufacture. This is probably due to the fact that each manufacturer uses a different grade and he is attempting to discover the best use he can make of that grade.

The results of these Bureau of Standards tests, however, when completed, should give the automotive manufacturer a fairly clear idea as to what sort of material produces the best results and the car manufacturer can judge for himself as to what make is best suited for his particular car. Tests are still being conducted, and their results are not yet fully known. They are being conducted along two lines, however, one a test under severe service conditions and the other a long wear or durability test.

Little has been said so far concerning the use of asbestos for clutch facings. Molded clutch facing has been on the market for something over a year and is used as standard equipment on a few passenger cars and trucks. The process of manufacturing this molded material is a secret and little is known about it except that it is compressed by hydraulic machinery. After compressing the material into the shape desired it is generally ground in order to present a smooth even surface. It is claimed that this molded facing has a higher coefficient of friction and is more durable than the woven type, but experts have expressed the opinion that its results will not prove satisfactory.

The type most in use at present, however, is the woven, or disk clutch. It is estimated that 274,139,000 sq. in. of disk and plate clutch facings will have been used on passenger cars along in 1921. Approximately 40 per cent of the trucks registered use a disk or plate type of clutch, and while it is difficult to give a safe average of the number of square inches of facing used on these trucks, it has been estimated that it would run in the neighborhood of 110,000,000. One process used in the manufacture of woven clutch facings, as well as brake linings, is to weave the asbestos and brass wire into a compact mass and then to impregnate it with a water and oil-proof binder to prevent the absorption of moisture and then to shape it.

While asbestos is not absolutely indispensable to the make-up of a motor car, it has thus far proven itself to be about the most economical and efficient material to be found for the uses to which it is put. There are many manufacturers who consider other materials better for

certain parts, and perhaps they are justified in their opinions. In the main, however, they have pretty generally agreed upon the basic parts in which asbestos should be used.

It is certain that the development of the automotive industry has done much to develop the use of asbestos, not only in automobile but in other machinery. Although there has been no concerted movement among asbestos manufacturers to study the automotive industry with a view to increasing the use of their product, it is believed that most of them, individually, have spent considerable time in planning its use in new ways.

Automotive engineers, on the other hand, have apparently paid less attention to the product. Naturally they have spent some time in studying its uses, but a well-informed engineer said recently that there had never been anp particular research work done along the lines of determining what grades of asbestos are best suited for different uses. Automotive engineers should remember that there is considerable variance in the chemical formulas of various grades of asbestos. This is true of the grades produced in different countries and different sections. These differences have a material result in the quality of the manufactured article made from them. As a matter of interest, there are shown herein Canada, Arizona and a variety known as crocidolite with the chemical properties of grades of asbestos mined found in Blue Cape, Africa.

Arizona Chrysotile Asbestos

	Per Cent
Magnesium Oxide, MgO	41.85
Silica, SiO_2	41.35
Iron Oxide, FeO	0.69
Alumina, Al_2O_3	0.91
Calcium Oxide, Lime, CaO	0.07
Water of Constitution, H_2O	11.96
Water, Hygroscopic, H_2O	1.38

Crocidolite Blue Cape Asbestos

	Per Cent
Magnesium Oxide, MgO	2.3
Silica, SiO_2	51.1
Iron Oxide, FeO	35.8
Soda, Na_2O	6.8
Water, H_2O	3.9

Canadian Chrysotile Asbestos

	Per Cent
Magnesium Oxide, MgO	40.07
Silica, $Si0_2$	39.05
Alumina, Al_2O_3	3.67
Iron Oxide, FeO	2.41
Water of Constitution, H_2O	14.48

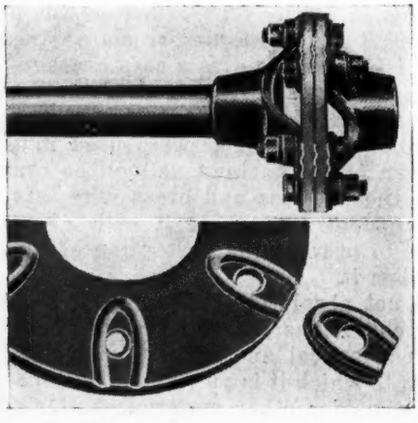
In the manufacture of brake lining it has been found necessary, as well as economical, to use a small admixture of vegetable fibers in order to secure from the asbestos producing machinery an adequate production of a properly fabricated material. The introduction of an excessive amount of this vegetable fiber will inevitably result in a finished brake lining that will give inadequate service, and which in some cases has been responsible for the loss of human life. A maximum percentage in the mixture of asbestos with vegetable fiber is 15 per cent of the latter. Smaller amounts may be used for different weights of cars and it is necessary for the engineer to determine what percentage will be required in the car he is designing. Any greater percentage, however, will burn out readily, leaving a residue of inefficient material which in a comparatively short time must be replaced. Replacement costs amount to many times the difference between the original cost of a good material and the cost of an inferior one.

The automotive engineer should also study the quality and grades of asbestos to be used for other parts of the car. While this has been done to some extent there could undoubtedly be more thought given the question with the result that advantages would accrue to all concerned.

As has been said, asbestos is not indispensable to the make-up of a motor car, but since it has been found an efficient material for the parts in which it is used, its qualities deserve consideration. The part it plays is important and an unsatisfactory automobile can result from the use of poor asbestos.

Improvement in Fabric Universal Joint

LAST summer the Merchant & Evans Co. supplemented its line of metal universal joints by a fabric type known as the Griptite, of which a description and illustration appeared in AUTOMOTIVE INDUSTRIES of July 14. Some changes in design have now been made in the fabric disks of this joint, particularly as regards the holding feature. As shown by the accompanying illustration, a secure driving connection is obtained by displacing the layers of fabric and rubber from their normal plane while in the vulcanizing mold into substantially radial folds across the surface of the disk, transverse to the line of torque, and gripping these folds with formed steel washers closely fitting this whole folded area. It is claimed that the folding of the fabric, the form of the washers and the close fit of these elements over an ample area without washer ridges or teeth to bite and chew the fabric give the combined effect of lasting tightness of assembly in road use, high torque capacity and great durability.



Griptite fabric universal joint

IN the course of a lecture before the Birmingham Metallurgical Society, E. R. Taylor described an unusual form of trouble which was experienced in the heat treatment of some small engine parts. The right degree of hardness failed to develop, although the composition was quite up to specification. The cause was discovered to be a current of air passing along the bed of the muffle, producing a film of oxidation on the surface of the steel. The matter was remedied by scattering small fragments of charcoal about the size of peas over the bottom of the muffle, the engine parts being put into the muffle on a tray. The charcoal became oxidized instead of the steel, and the trouble was corrected.

Definite Ruling on Heavy Trucks Is Urged

Bureau of Public Roads declares highway engineers must have accurate knowledge as to what loads roadbeds will be expected to support. Heavy trucks should prove their economic value if they are to be permitted to operate. A definite ruling would also materially aid the manufacturer.

THE heavy motor truck is perhaps the most formidable problem confronting the highway engineer of to-day. State and federal officials are at a loss to know how to deal with it. Some state officials are taking what they consider the easiest way out and allowing only certain sized trucks to operate in the state; other states are attempting to build roads that will withstand the assaults of these vehicles. In all cases it is looked upon as a problem. Few persons deny the economic value of the heavy motor truck to the operator, but at the same time many are not convinced that it is of such general value as to warrant expenditure of huge sums for road construction and maintenance so as to allow its operation.

The Bureau of Public Roads of the United States Department of Agriculture, in its annual report, recognizes this condition and suggests either proper regulation of these vehicles, or else restriction of their use to certain highways, built, of course, to carry them. The bureau declares that the problem grows more important each year and is one which, while not to be hastily solved, ultimately must be met squarely and disposed of.

"Whether the operation of the heavier vehicles," says the report, "shall be restricted to a class of roads especially designed to accommodate them, or whether all roads shall be strengthened for unrestricted use, or whether the third alternative shall be adopted and the operation of the heavier trucks prohibited, will depend upon the relation which is found to exist between reduced operating cost and increased cost of construction."

By reduced operating cost the bureau means that reduction that would come from improved highways.

The report goes on to say that there must be a careful weighing of the effects of the several possible solutions with a view to the selection of that one which in the end will accomplish the desired result—improvement in the nation's means of transportation.

Problem Affects All

Such a program would prove of lasting benefit to the automotive industry. The problem is one which affects everyone concerned—the manufacturer, owner and highway engineer. As conditions stand at present the manufacturer is in a more or less uncertain position as to his future program. Obviously, if legislation is to be enacted that will prohibit the operation of vehicles above a certain tonnage prospective truck purchasers will not purchase trucks above that tonnage and it will be useless for the manufacturer to plan for the production of that type. On the other hand, if these vehicles are to be permitted to operate only on specific highways then the manufacturer must learn, as soon as possible, where these highways will be and how many miles of them there are to be. If the unrestricted use of heavy trucks is brought about, and all future highway construction is designed to carry the heaviest vehicles then the truck manufacturer can be fairly well assured that there will be an increased market for heavy trucks.

Such a solution as the final one is, of course, the most desirable from the standpoint of the manufacturer. It has been proven in many instances that the economic advantages of the heavy truck offsets, by far, the increased cost of highway construction. The bureau report admits that its investigations have proven this in one instance, but "it is not by any means certain that the outcome will be so fortunate under other conditions."

Need for Coordination

It would seem, therefore, that there is need for a great coordinated effort to bring about a solution of this problem. The automotive manufacturer must prove that the heavy motor truck is a factor in the transportation system of the country and its needs must be provided for. Highway construction, it is admitted, is expensive, and is worth while only when it can be shown that the expense is justified. The laws governing truck transportation prove that the truck of greatest capacity is the one that will allow the cheapest unit cost of operation, and still cheaper operation can be secured if proper highway facilities are provided. There is a great deal of logic to be found in the bureau's suggestion that heavy trucks be permitted to operate only upon designated highways. That, however, should hold good only until all the roads of the country are designed to carry these trucks, or at least all the principal roads.

There is the possibility that heavy trucks might never pass over certain stretches of road, even though they were designed to carry them. This is also a problem to be considered in mapping out a national highway program. Varying needs are to be found in different communities, but the thought should also be borne in mind that as better highways are built their use increases. In a certain sense good roads are the result of a demand from owners of automotive equipment, but on the other hand, when good roads are built the use of automotive equipment increases. Consequently, in communities where at present there may be no heavy trucks in operation, the fact that improved roads were built might cause several to be put into operation. Thus highways designed to carry only lighter vehicles, in such localities, might soon be crushed beyond recognition as highways should some individuals decide that better roads warranted their using heavy trucks in their system of transportation. It is this danger that must be overcome in future highway construction.

Whatever the future highway program is to be, however, it is quite obvious that a decision one way or another as soon as possible is desirable. It is believed that a systematic analysis of the problem will prove that the heavy truck has won a place for itself in the country's trans-

portation system. Certainly it has done so in many localities, and if it has not in others the reason has been largely due to the fact that improper highway facilities were afforded.

One important step is now being taken by the bureau, and that is the conducting of tests to determine accurately the load carrying capabilities of various kinds of roads, of various thicknesses upon different kinds of subsoils. This study will yield valuable information in meeting the problems outlined. Comparatively little is known at the present time about what types of road are best suited for different localities. The fact that two states, having practically the same conditions, adopted radically different methods of highway construction proves that there has been no coordinated effort along this line. An accurate knowledge of these facts would enable engineers to determine the approximate cost of a highway construction program that would permit the unrestricted use of the heavy motor truck. With the knowledge of that cost it would be comparatively easy to show whether or not the economic advantages of the truck warranted the carrying out of such a program.

Brass Forgings a New Industrial Product

FORGINGS of brass and bronze, while relatively new in this country, have been used in Great Britain and on the European continent for a considerable time. A commercial line has, however, been developed by the Mueller Metals Co., at whose plant the commercial application of forged brass has been taken up on a large scale. Some idea of the various units which have been successfully turned out by this process may be gathered from the accompanying illustration of about forty automobile parts of forged brass. Nearly all the parts shown are used on well-known automobiles or trucks.

The tensile strength of brass sand castings are in the neighborhood of 30,000 lb. per sq. in., while the forgings have a strength of 62,000 lb. per sq. in. The forged bars show an elongation of 40 per cent, and break only after considerable reduction in area. The sand-cast test bars show an elongation of only 14 per cent and very little reduction in area.

In manufacturing the forgings, the blanks are heated in an oil furnace and the forgings are made in a 400-ton double-acting press. About 600 impressions are made per hour. There are also single-acting presses making 900 to 1000 impressions per hour. On small pieces, such as elbows, where several are placed in one die, more than 5000 parts have been produced per hour.

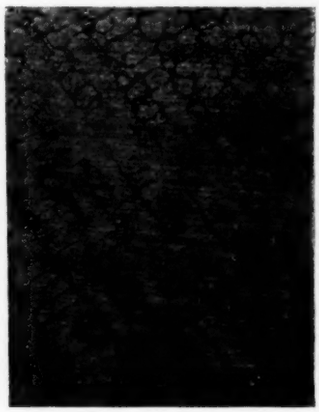


Fig. 2—Micro-photograph of brass sand casting. Tensile strength, 30,000 lbs. per square inch

Fig. 3—Micro-photograph of brass forging. Tensile strength, 62,000 lbs. per square inch

Fig. 1—A collection of forged brass automobile parts

Forgings up to 3 lb. in weight have been successfully produced by this method, and it is expected that new developments will permit of even larger units. It is stated that when necessary, the diameters of cylindrical forgings can be held within limits of plus or minus 0.002 in., but that it is not feasible to hold other dimensions closer than 0.008 in., owing to the variations in the size of the blanks to be forged and consequent springing of the press.

The forging process makes the metal more dense and consequently reduces the chances of porosity. It is claimed that in some instances it is more economical because it is possible to forge close to the finished size and consequently to avoid waste in cutting away a large amount of metal. The metal is also said to be freer cutting.

FROM U. S. A. Ireland imported in 1920, 2,269,000 gal. (British) of gasoline valued at $544,682 (without duty) and 63,145,087 gal. (British) of mineral oils (kerosene) valued at $3,420,839, and 2,269,510 gal. (British) of lubricants valued at $544,628. The value of imported tires and tire parts was £23,834 ($119,170) from U. S. A.

Buses Major Transportation Medium in Porto Rico

Motor buses are carrying more passenger traffic between the two major cities than the railroads. Trucks extensively used for freight transportation. There are now about 1000 miles of improved roads on the island and extensive highway construction is being carried forward at present.

HUNDREDS of motor buses and several thousand automobiles are in daily use in Porto Rico for the transportation of passengers, and it can be truthfully said that there is no town or village within the island that cannot be reached to-day by automobile. Buses connect the principal cities, the longest line being that from Ponce to San Juan, a distance of 131 kilometers (81 miles), while many others, differing widely in type and size, run between the larger centers and the outlying villages, so many of these lines existing, in fact, that practically all transportation of passengers within the territory is done by automobile.

This expanded use of the automobile is one of the outstanding facts of recent years in Porto Rico. The motor car is no longer considered a vehicle of luxury or pleasure, except by a small part of the population, but, rather, it has become the dependable and customary agent of transportation, performing valuable and necessary services for the island as a whole.

Some months ago a survey of Porto Rico showed a total of about 1000 miles of good roads, and the governmental department in charge of highway work is continually adding to this mileage, in addition to keeping in maintenance the roads already established. The principal highway is the road between San Juan and Ponce, across the island, and there is also a very good macadam road between San Juan and Mayaguez, passing through Arecibo and Aguadilla.

Increase in Buses

Trucks are extensively used, as would be expected, for transporting merchandise to sections, many of which are not connected with the chief centers by railroad. Also, during recent years, a remarkable increase has been made in the operation of trucks converted into passenger buses. These, with their special bodies, seat from 20 to 30 passengers, and new trucks are constantly being put into the passenger-carrying service. One large truck representative, who has been selling from two to three trucks each month for the last year or so, reports that 80 per cent of these vehicles are equipped with bus bodies.

The San Juan-Ponce line runs two buses daily in the regular service from each city, covering the 131 kilometers in from 4½ to 5 hours. Their seating capacity carries 24 passengers comfortably, with light baggage. A large number of smaller cars are in service carrying passengers between other towns all over the island, some of them operating on regular schedules, while others make their trips whenever there are passengers.

The automobile has practically supplanted the railroad for the transportation of passengers between the two chief cities. The railroad is built along the coast, thus more than doubling the distance of the cross-island road and consequently requiring a much longer time of travel than do the buses. This railroad runs from San Juan to Arecibo, Aguadilla, Mayaguez and Ponce, its distance being 274 kilometers. Another short-line railroad connects San Juan with Caguas, 36 kilometers distant, but it carries few passengers, those making the trip generally preferring to do so by automobile.

Transportation Costs

Both passenger cars and buses leave San Juan daily for Fajardo, Guayama, Juncos, Humacao and other points in the interior. The fares are considered reasonable, despite the cost of gasoline. It is possible, for instance, to hire a six or eight-cylinder car, seating five or seven passengers, for the trip between San Juan and Ponce for from $16 to $35, depending upon the make of car.

On the other side of the island from San Juan there is similar motor service from Ponce. Buses leave daily for Yauco, Adjuntas, Guayama and other interior points. From San Juan some 200 light cars and buses are in daily service to carry passengers to and from Rio Piedras and Santurce, the residential suburb of the city. The number of these vehicles increases daily.

The use of automobiles throughout Porto Rico has shown a steadily increasing number during recent years. In December, 1920, an official statement of the Department of the Interior listed 4780 motor vehicles, but in the intervening months this number has so increased that the present total is at least 5500, although some estimates place the total at from 6000 to 7000. However, the smaller number seems the more authentic and is probably a fairly accurate census.

The year 1921 showed a large decrease in the sales of automobiles in Porto Rico, the same as in practically every other country of the world. The automobile dealers, however, are feeling much encouraged at the prospects for the months to come, as sales already have improved materially. The return to normal sales conditions depends, of course, upon the sugar industry, but, according to present indications, business in the island should better itself very much in the near future.

Fiat to Enter Indianapolis Race

FIAT is expected to send two racing cars to Indianapolis next year in charge of Louis Wagner and Pietro Bordino. The Fiats are 183 cubic inch eight-cylinder-in-line engines built for the French Grand Prix of this year, but not ready in time. They have only been raced once, on the Brescia course, Italy, last September, when they established a world's road record, but were beaten by the Ballots over the total distance.

Metallurgist and Engineer

Editor, AUTOMOTIVE INDUSTRIES:

Mr. Pomeroy's letter signed "Foralum," appearing in your issue of Dec. 8, 1921, struck me at first as being little more than a semi-facetious attack upon myself prompted, perhaps, by not unnatural irritation at the fact that I did not agree with Mr. Pomeroy in regard to the desirability of employing castings for frame construction. From that point of view, I should gladly have left the matter to the sense of humor of your readers. Unhappily, however, Mr. Pomeroy raises the issue of "engineer vs. metallurgist," and while I am far from wishing to pose as the representative metallurgist, I must yet decline to accept Mr. Pomeroy as the typical engineer. I have, both personally and professionally, many dealings with engineers, both automotive and others, and always find them very ready to appreciate whatever the metallurgist can do for them. The proper relation between these two closely allied professions should surely be one of mutual help and understanding, and without any trace of such hostility as seems to peep out from Mr. Pomeroy's remarks.

In his first paragraph, Mr. Pomeroy suggests that "the metallurgist" is taking upon himself what "the engineer" dare not do—apparently to suggest the right way of employing new materials of engineering. He follows up this attack by referring to "some of the finest real engineering the world has ever seen" and having been carried out "before the metallurgist was ever heard of." I can only suppose that he is thinking of the Pyramids of Egypt or similar works, but Mr. Pomeroy would hardly regard these as useful examples from the point of view of automotive engineering. Actually, engineering and metallurgy have always progressed together.

Mr. Pomeroy gives away his whole case, such as it is, by demanding that the metallurgist should tell the engineer what test should be applied to ascertain the value of any material. Surely, in so far as the functions of the two can be really separated at all, it is for the engineer to specify his requirements and for the metallurgist to do his best to fulfill them. The engineer is in the best position to ascertain the nature and extent of the stresses which occur in his structures, and when he has told the metallurgist precisely what he requires the metal to resist, then it will be possible for the metallurgist to predict with real certainty what material will withstand the conditions. It is useless for Mr. Pomeroy to demand, vehemently, that the metallurgist should state the value of all materials in terms of the steel "which the engineer knows." How far *does* the engineer know his steel any better than he could —if he wished to avail himself of the existing data—know some of the newer alloys? One who, like myself, has frequent occasion to examine breakages and failures, soon comes to realize that the engineer, on the whole, cannot be so deeply familiar with the properties even of steel—or, if he is, he sadly neglects that knowledge at times. Here, again, it is essential that engineer and metallurgist should work in harmony and achieve progress together. It is, surely, only a step toward that co-operation for the metallurgist to put forward his views and suggestions for the utilization of new materials which he has studied, and it is a distinctly retrograde step for any engineer to attack a metallurgist in general terms because he has done so.

The more detailed portions of Mr. Pomeroy's letter are difficult to treat in any limited space. Were I to follow his methods, I should be inclined to refer to the well-worn quotation as to the considerably greater ease of asking questions as compared with answering them. However, some of his points may be dealt with seriatim. Thus, he objects to the attempt to estimate the value of materials for constructional purposes by means of the ordinary mechanical tests—tensile, impact, etc. There is much to be said for that point of view, except this—that as yet there is not only no better way, but no alternative way at all. On the other hand, Mr. Pomeroy evidently has only hazy ideas about the nature of what he calls "stress hysteresis" and fatigue generally. I might, perhaps, refer him to some of my earlier articles in your columns, and would only mention here that the standard "fatigue" tests throw the fullest light on the endurance of metals in that range of stress "before failure commences" in an ordinary tensile test. Mr. Pomeroy says that the engineer wants to know what takes place before failure begins, but what the engineer really needs to know is at what stress or range of stresses failure really will begin—and *that* the fatigue test can and does tell him. No doubt it is necessary to correlate the indications of all tests with the results of actual service—but that correlation serves to add to the value of the tests and not to eliminate them; also—in the case of new materials, it is not as yet obtainable.

Mr. Pomeroy deals with the piston and his anger is mainly directed against the suggestion that a forging rather than a casting is likely to be "the" piston of the future. In support of his view he instances the troubles of pressed steel pistons, but quite ignores the point that those failures were really the result of wrong design. In the aluminum alloy piston, there is—owing to the lightness of the material—no need to use very thin sections and thus the main difficulty of the thin steel piston disappears. As regards production—in connection with which Mr. Pomeroy brings off his concluding flash of humor—I can only say that evidently production engineers differ a good deal in their views, since the request for the development of aluminum alloy forgings for piston purposes actually came to me from an engineer who wished to avoid the loss, in production, arising from the frequent occurrence of wasters due to unsoundness in the castings with which he had been dealing.

This brings me to the main question of "castings vs. forgings," or wrought material generally, which Mr. Pomeroy raises. And here let me say that I am not by any means speaking from the point of view of the test-piece, but from a very wide experience of actual castings and forgings produced for war and other purposes. Undoubtedly much is to be said for the use of a casting where it can be really rationally applied. In it the metal can be readily brought into the desired place, and—particularly if the engineer ignores the real exigencies of the foundry —castings of delightfully complicated shape can be produced. All this would be quite conclusive, and we might

even regard a cast aluminum-alloy automobile frame as a really reasonable proposition, if two conditions could be fulfilled. The first of these is the production of castings whose actual working strength—say power of resisting shock and fatigue—was comparable with that of wrought material of similar specific gravity, and second, if we could always and uniformly rely upon the complete soundness of the castings. I would suggest, on the basis of the wide experience referred to, that neither is the case. Recent research has produced castings whose tensile strength is not far short of that of the best wrought alloys, but their resistance to fatigue and shock is still decidedly lower. Is it, then, rational to use the cast material in any position where wrought material of equal weight and greater strength can be employed? In the pre-aluminum days, would Mr. Pomeroy have suggested the use of a cast-iron frame for an automobile in preference to wrought and heat-treated steel? Yet this analogy is strictly fair unless we consider the new heat-treated castings, which might perhaps be likened rather to cast steel than to cast iron. In aluminum alloy castings it is never possible to be really sure that invisible defects may not seriously impair the strength, unless the casting is of a particularly favorable shape. Castings required for frame construction, however, if they are to be economical of weight, must necessarily be long and narrow, with comparatively thick lugs attached to them—an ideal combination for producing "drawing" and unsoundness. When the aluminum alloy has first been cast as a simple ingot or slab and has subsequently undergone rolling or forging, coupled with careful inspection, the possibility of serious internal flaws is practically eliminated, so that wrought material is definitely much more reliable than cast. Furthermore, it is not easy to produce castings of the light sections which can be satisfactorily used in wrought material. All these considerations, although they go to show the undesirability of using castings for such a purpose, by no means prove that it cannot be done.

With regard to the question of springs, I am not prepared to enter into a discussion of the theoretical formulæ of the engineer; if Mr. Pomeroy's figures are right, there is not likely to be any great saving in weight by the use of light alloy springs. At the same time, I would still advocate a trial, since the exact effect of a different ratio of density to elastic modulus may bring with it unexpected effects. Furthermore, Mr. Pomeroy's calculation seems to me to apply only to material under uniform stress and to neglect the fact that in a spring of given stiffness, the material might be quite differently distributed if it were aluminum alloy as compared with steel. This may make it possible to utilize the material more efficiently, since it is evident that in any ordinary spring only part of the material—indeed, only a small part—is stressed up to the maximum range which the metal can withstand.

It is evident that the questions raised by Mr. Pomeroy afford room for much discussion, which might be profitable if it were pursued in the true spirit of inquiry and in an effort at closer co-operation between engineer and metallurgist. To any sort of controversy in which they appear as adversaries, however, I think it worse than useless to contribute. In this I feel sure that the broad-minded engineer will agree with me.

WALTER ROSENHAIN.

Steering Creeper Tractors

Editor, AUTOMOTIVE INDUSTRIES:

The article in AUTOMOTIVE INDUSTRIES of Jan. 26, 1922, by Mr. H. C. Oliver on "Steering Track-Laying Vehicles" looks very simple on paper, but I do not believe it to be of practical value.

The power required to turn the worm wheel (13) on the differential (12) is considerable, also its speed for short turning is greater than a hand wheel could be turned conveniently.

The same principle could be worked out by friction disks, but of course the cost and poor efficiency of the scheme prohibits it.

Tractors of to-day and to-morrow must be made of the fewest number of parts that will meet the requirements and come within competition costs.

VICTOR L. DARNELL.

Brake Design and Materials

Editor, AUTOMOTIVE INDUSTRIES:

On page 243 of the February 2 issue of AUTOMOTIVE INDUSTRIES it is stated in connection with "Better Brakes" that "it is next to impossible to provide adequate brakes for long and difficult grades when these alone are depended upon for the necessary retarding effect."

As you know from former conversations, I am not in accord with this statement, which, I think, is contrary to the proved performances of the best English and European practice.

Brakes can be designed without excessively expensive production which shall be absolutely trustworthy for all uses to which they may be put, in any class of hilly or mountainous country, and it should never be necessary to waste fuel by using the engine as a brake for long distances. Neither should it ever be necessary to descend a hill in a low gear.

Brake materials are now being manufactured which will not burn out, and which do not lose in friction as they grow hot. They are being used on a large number of electric railroads in England and the continent, with a consequent absence of the "flat-wheel" bugbear which curses electric transportation in this country. They are also being used by most producers of good automobiles in Europe and nearly all large omnibus companies. Recent public trials in England have demonstrated that American cars often burn out their brakes, while the local cars do not.

I suggest that it is necessary for the American industry to fully realize how far behind it is in brake design and materials if it is ever to put right this one defective point which militates against its cars all over the world.

I, therefore, suggest the writing of a much stronger article on this subject which shall deal specifically with: (a) The form of brakes, provision for cooling, excluding dirt, etc.; (b) the material of the brake linings, and (c) the correct design of brake actuating mechanism from the lever or pedal to the drum.

MAURICE OLLEY,
Engineer, Rolls-Royce of America, Inc.

TESTS which have been carried out with a system of guiding airplanes in fog by means of the reception of impulses from a ground cable are reported to have yielded satisfactory results. The apparatus, which has been designed by Lieutenant Loth, of the French Navy, will, it is believed, enable regular commercial flights to be made under night and fog conditions which at present render air services impossible. The pilot is able by means of the receivers installed on the machine to ascertain his position with remarkable accuracy, and it is understood that a cable will be laid on a portion of the London-Paris route in the near future. Night flying in clear atmospheric conditions will be assisted by the modification of marine lights to suit the needs of aviators, by landing lights, and by the development of improved navigation lights on the machine.

Car Market Depends on Local Service

The character of the automobile is such that its usefulness is measured by the service it renders. Mr. Tipper stresses the value of giving efficient service and urges retailer and manufacturer to co-operate with service as a goal.

By Harry Tipper

WHEREVER the automotive industry has touched, whether upon production, distribution or finance, it has introduced new elements and revolutionized to some extent the functions previously associated with those departments of business. In the retailing of automotive equipment, the very necessities of the case introduced other functions which were not associated previously with retailing and which separate the business of retailing automobiles from that of any other retail business. This is the first time that any really complicated mechanism has been sold in large quantities to the general public to be used by amateurs or laymen. Wherever complicated machinery has been sold and used in the past it has been subject to the care of experts skilled in the understanding of machinery, the adjustments and the repairs. The automobile is more complicated than many other types of machinery, yet it is sold to people without any technical training and is handled by them without any particular regard to the ordinary care which a skilled operator would expect to give such a piece of machinery.

The automobile is not a piece of merchandise. It is a means of transportation and its usefulness is confined to the extent of the service which it will render continuously. During the experimental period in the development of the automobile, those who were skilled mechanically, or fond of mechanics, attempted to use the new vehicle. When the automobile passed this stage, and became thoroughly useful, the great necessity before the industry was to provide a sufficient number of automobiles to meet the needs of the population. With the present extensive population of cars we are passing into the stable period, where the service rendered by the vehicle becomes of the utmost importance. This service cannot be maintained by the users of the cars themselves without the adjustment repair incident to the use. This adjustment, etc., must be done by the retailer of the car and by other establishments created for this purpose.

The future tendency is for the car market to depend more and more upon the character of the service which is available locally for its continued operation, and less upon the car itself apart from that service. Probably 90 per cent of the people who buy cars in 1922 have owned a car previously. Consequently, they have some background upon which to estimate comparatively the value of the car, and this background is concerned almost entirely with the way in which the car delivered service.

THE future tendency is for the car market to depend more and more upon the character of the service which is available locally for its continued operation, and less upon the car itself apart from that service. Probably 90 per cent of the people who buy cars in 1922 have owned a car previously. Consequently, they have some background upon which to estimate comparatively the value of the car and this background is concerned almost entirely with the way in which the car delivered service.

Any complicated piece of machinery requires a certain amount of adjustment, cleaning and other care, no matter how thoroughly it has been built or how carefully it is handled. There is a very much heavier demand for this adjustment, minor repairs and little points of service in connection with the automobile because of the conditions under which it is used and the fact that the owner is not skilled in providing these points of mechanical care. As the car grows older, the repairs become more extensive and the required service larger if it is to be kept in running condition at all times.

In this respect the individual establishments vary in their efficiency more perhaps than in any other respect. The cost of repairing and adjustment, the length of time or actual skill and efficiency of the work vary within very wide limits, so that no car owner can be assured of getting the same character of service in two different localities or securing any reasonable expectation of cost. This problem of the service to be rendered by the retailer is one of the utmost importance to the industry. The market for any particular car in any locality is very seriously affected by the condition of the service available for the operation of that car in that locality, and so long as there is such a variation between the character of the work done and the price at which it is to be secured, the use of the car will be limited more than it should be limited.

The growth in the number of automobiles has been somewhat more rapid than the growth in the number of establishments equipped to give the thorough service required to keep the car in condition and to make the ordinary repairs.

Too many establishments in the field do not possess sufficient knowledge either from the mechanical standpoint or from the standpoint of ability to organize, so that the work costs too much and many times it is incorrectly finished. There is a disposition to charge all the traffic will bear in many cases, and to charge a different price for practically the same work in individual cases. A comparison of the cost of conditioning a motor under the same general requirements in four or five different establishments indicates the wide variation in the methods of estimating and the methods of operating on the same job.

To the car owner the retailer who affords reasonably good service represents a reliable authority and his influence upon the whole sales position is in accordance with the authority and expertness exhibited in his work.

No amount of sales work or sales promotion work to the individual owner will offset the influence exerted through the service rendered after the car is sold.

Although the average owner is not mechanically informed, and cannot check up the character of the service from a mechanical standpoint, it is obvious to anyone who watches these conditions that the retailer who is offering excellent service speedily becomes known in his locality and finds his business of servicing extending beyond the cars he may be selling because of the anxiety of the owner to secure reliable service. It is important to the manufacturer of cars that there should be a great improvement in the general average of efficiency in the service rendered and a very much better understanding of the methods to be employed in providing it at a reasonable cost. It has been customary with some manufacturers to work with the retailers for the provision of a standard service as to the cost of parts and the methods of operation, varying only with the cost of labor. It is not enough, however, that some uniformity should be secured in the matter of providing service for the particular make of car, but it is necessary for the retailer to understand the importance of service in connection with the automobile sale and the influence exerted by the character of the service upon the whole progress of the establishment. In this respect, as in other respects, the understanding and ability of the retailer needs to be amplified and developed if the service is to keep pace with the requirements for it and respond to the demands made upon it by the users of the automobile.

In no other problem connected with retailing can the manufacturer be of more benefit, through a close degree of co-operation, than in this matter of the service to be given to the car after it has been sold. The problems met by the manufacturer in experiment and production and the intimate knowledge he possesses as to the detailed construction of the car make it possible for him to co-operate with his retailers very closely in the endeavor to improve the character of the service and take advantage of its influence upon the market. The service to be rendered should be plainly visible in its value to the owner, arranged so that cost can be estimated and conducted under a fairly standard knowledge of the elements of cost, so that the user will be able to make his comparisons. The character of required service should be studied so that the importance of different elements is determined and arranged for upon a basis which will provide as nearly as possible a minimum of cost for each job.

In this connection it will be necessary for the manufacturer of an automobile to review very carefully the replacement prices demanded for parts required more or less regularly in the servicing of cars and their repair. The cost of manufacturing such parts is naturally higher than the cost of the parts going through the shop on a production schedule, but there exists a wide difference between the prices charged by manufacturers to retailers on parts which are almost similar, and unless the manufacturer is willing to bring his own servicing business into line, it will be futile for him to expect the retailer's service station to operate along standard lines with maximum efficiency. It becomes more and more obvious that service has a great bearing upon the sale of the car. The popularity of certain cars in certain localities can be traced very largely to the character of the service rendered in comparison with others in the same price group. The diversion of buying from one car to another in the same locality is frequently associated with a change in the agency. As the population of cars grows, the future of the whole business is wrapped up more and more in the service rendered in keeping the car in running condition. This is not a problem of the retailer alone—it is the problem of the manufacturer and the retailer to be worked out only in co-operation and with a careful examination of all the factors—the cost of parts, the reasonable time to be devoted to a job, the cost of labor, the allowable variation in the price, the promptitude of the service, the convenience and other matters. These things should have a consideration when the contracts are made between the manufacturer and the retailer or between the distributor and the retailer. They should be a part of the requirements, and the manufacturer should be prepared to do his part of the work in the enabling of service stations to meet these requirements and live up to them.

Specifications for Tires and Tubes

DURING the war the Bureau of Standards undertook an extensive investigation of tires and tubes, with the object of preparing specifications covering such material for military use. This work was highly successful, and as a result numerous branches of the Government adopted the Bureau's specifications.

Circular 115 of the Bureau of Standards, obtainable from the Superintendent of Documents, Washington, consists mainly of a revision of the specifications prepared by the Bureau and now used by the War, Navy, Treasury, and Post Office Departments, the Panama Canal, and General Supply Committee. These specifications were recommended by the United States Interdepartmental Committee on Specification Standardization in June of last year.

A tentative draft of the specifications was submitted to a large number of representatives of the tire industry, including the Rubber Association of America, and in the revision careful consideration was given to their recommendations.

The specifications are divided into three parts—pneumatic tires, solid tires, and inner tubes—and contain a detailed description of the physical and chemical requirements.

In connection with pneumatic tires, the character and strength of the fabric, the composition of the friction compound, width and weight of the fabric for the breaker strip, the compound from which the cushion is made, and the quality and quantity of the rubber in the tread are carefully considered. The construction of the side walls and the bead, as well as the tire sizes, are likewise specified. A mileage of 6000 and 8000 is required for fabric and cord tires, respectively.

In the case of solid tires, the composition of the tread, its strength and method of fastening to the base band, and the chemical analysis of the base band, together with its tensile strength, are specified.

Analytical and physical requirements are laid down for inner tubes which are divided into three classes—pure gum, red antimony, and compounded tubes—the latter to be used only in 6-in. or larger sizes. In connection with the tubes, minimum diameter, length, thickness, volume of rubber and inflation test for the different sizes of tubes are specified.

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Stable Markets

THE following statement was made before a convention of the National Foreign Trade Council by Guillermo A. Sherwell, a member of the Inter-American High Commission:

"We are impatient; we want immediate results; we cannot wait. We are like the child who wants to cross the street, who simply must cross even though he will be crushed by a car. Our boys want to run and to play; our university students want credits this year rather than knowledge when they leave the university; our bankers want money to-day rather than the business of the future, and our buyers and sellers want large profits right away rather than a sound, permanent market."

While the above statement was made in reference to our foreign trade, it has an application as regards our domestic business as well.

The rate of growth of the automobile business has been so swift as to make the cultivating of a sound, permanent market appear far less essential than it has actually become within a comparatively short period of time. With the transition from a condition of striving to fill the demand of the market to that of finding a market to absorb production, the necessity of cultivating a stable market appears to be of paramount importance.

Emphasis on market analysis to determine the market potentialities, and a stressing of those factors which constitute the rendering of a service to that specific market when secured, will lay the foundation for permanency and soundness. A market which is over 80 per cent a replacement one determines the direction in which manufacturers will have to travel. Soundness and permanency are no longer a question of choice but of necessity.

Improving Contracts

THE statement has recently been made that the best dealer organization is the one in which the individual dealer assumes a maximum of personal responsibility. Granting that this is so, our immediate object should be to make the relationship between the manufacturer and the dealer so satisfactory that the latter will be eager to assume the maximum of personal responsibility.

It is only just that the dealer should have the assurance of reaping the fruit from the market that he has cultivated. Sometimes there seems to be a feeling that the dealer should only be allowed to grow to a limited size before a pruning process be applied to his territory. Well-established dealerships have even been taken over and used as a prize to give to someone who has made good at the factory or is in favor with the manufacturer.

Successful building up of a market within a territory must in itself be indicative of a creative spirit and ambition on the part of the dealer. Will not the nibbling away of established territory tend to decrease the dealer's productive efforts?

Now, there are two ways of disposing of pruned territory. Either it is attached to another territory or there may be a new dealership established to handle it. In the latter case it may be joined with the prunings from other contiguous territories. Here the question arises whether the possibilities of increased business through concentration on small territories will justify the increase of numbers in the selling organization.

The taking over of dealerships entire may be a gamble. It is not easy to determine the amount of business that was secured through personal contact of the customers with the former dealer, hence in many cases where it was an important factor there is a temporary if not permanent falling away in volume of business through loss of this contact.

Turnover in the selling organization should be confined to those territories where representation is unsatisfactory. Stability of the selling organization and continuity of selling effort are growing increasingly valuable.

With an improvement in the drawing up of contracts between the manufacturer and dealer, and there is, fortunately, a movement in that direction,

there should be borne in mind not only the granting of the maximum of personal responsibility to the dealer but the making of such responsibility desirable to him.

Lessons of the Roma Crash

ONE more catastrophal accident has been added to the list which marks the progress of lighter-than-air craft to date. Like that to the ZR-2, it will not check further experiments along this line, but the lessons which it teaches should be heeded, in order that further unnecessary loss of life may be avoided. As in the case of the big dirigible which fell into the Humber, the seriousness of the accident and the large number of deaths caused by it resulted from the combination of a number of unfortunate circumstances. So far as can be judged from the information at hand, the primary cause of the accident was failure in the elevator control, which occurred at a comparatively low altitude and caused the big ship to crash to earth at an angle of about 45 deg. Here it should be noted that the machine did not drop, that it did not lack buoyancy, but that when the altitude control ceased to function it assumed a downward inclination and crashed to earth under engine power. Had it been possible to instantly shut down all of the engines, the crash could undoubtedly have been avoided, for the buoyancy of the big bag would then have asserted itself and any downward speed acquired after the elevator gear first ceased to respond would have been quickly checked. Whether the failure to instantly shut off all of the engines was due to inadequate control provisions or to mistakes of the personnel remains to be determined.

Even better than stopping of the engines would have been a reversal of the propellers. This, of course, is impossible with ordinary propellers directly mounted on the crankshafts of the engines. The destruction of the Roma, therefore, is a strong argument in favor of either reversible pitch propellers or of geared propellers with reversing gear, such as installed in the dirigible now being built by the Goodyear company for the Navy. We would not think of putting to sea with a steamer or motor ship without reversing gear, and last week's accident shows that the ability to reverse the power of the propellers is equally essential to safety in a dirigible.

That so many people lost their lives in the accident was probably due to the unfortunate circumstance that the ship, in coming to earth, struck a high tension electric transmission line. Either the contact with the wires or the contact with the ground, which occurred a mere instant later, ripped open the gas bags, and the electric flashes from the broken transmission lines then set fire to the inflammable hydrogen gas. However, if the engines were still running when the crash occurred, there would seem to have been also a considerable danger of the hydrogen-air mixtures, which must have been quickly formed, to have become ignited by the exhaust flame.

This merely goes to show anew that as long as the highly inflammable hydrogen is used as a filling gas, any violent landing is almost certain to be accompanied by explosions, leaving the occupants very little chance to escape with their lives. If any further incentive were needed to make the non-inflammable helium (or hydrogen so much diluted with helium as to be non-inflammable) available for the lighter-than-air craft of our Army and Navy, the sad fate of the Roma should furnish it. There is much greater reason to use these non-inflammable filling gases in the present stage of airship development than there will be once the mechanical problems of airship construction have been fully solved, when forced landings will probably be very rare.

Making Men and Money

IN one of his now famous "Common-Sense Editorials," Bruce Barton recently said: "I sometimes think that successful business men should add a line to their letterheads after this fashion: 'John Jones and Company, Builders of Automobiles—and of Men.'

"And that somehow the Government should discriminate in levying taxes between businesses where men are merely used and those where men are made."

There is always a necessity for trained men in industry. To be assured of such men, industry must do the training. There is frequently too strong a tendency on the part of employers to demand skilled men, when those particular employers are doing very little to provide an opportunity for increased skill or personal development within their own organizations.

The man-building organization has growing within itself potential leaders; great driving forces which will produce and market most efficiently and consequently most profitably; forces which assure the permanent progress of the organization regardless of the coming or going of any individual, however important his function.

Building men instead of merely using them not only fulfills a social and industrial obligation but brings results to the organization in dollars and cents.

Taxes and the Bonus

IN connection with the recent suggestion of Congress to provide a soldiers' bonus largely through the contributions of the automotive industry, the result of the referendum of the Chamber of Commerce of the United States on the bonus is of interest. The members of the Chamber voted decisively against the granting of a bonus for ex-service men, 72 per cent forming the opposition. The referendum was sent out six weeks ago and final results have just been announced. These results confirmed the action of the Chamber previously at two annual meetings and can properly be interpreted as indicative of the sentiment of American business men.

The automotive industry has always stood ready to bear its fair share of tax burden, but the place has been reached where it is already bearing at least that fair share. The proposals of Congress for raising a third of the bonus from those using the products of the automobile industry had no basis in justice.

Notes of Willys-Overland Renewed

Defeat Is Indicated for Bank Creditors

Held Doubtful Now if Mortgage Will Be Placed on Company's Property

NEW YORK, Feb. 28—Bank loans of the Willys-Overland Co., aggregating $16,556,000, which matured to-day, have been renewed for three months.

This development is the most important in the recent history of the company. It indicates that the bank creditors who proposed to keep control by a $25,000,000 refinancing program based on mortgage bonds have been defeated by the other interests in the company. Any refinancing program must be submitted to the preferred stockholders, and it now is considered doubtful whether any attempt will be made to mortgage the property.

Toledo Dominates Board

By the election in the past ten days of six Toledo bankers and business men as directors of the company, nine of the eleven members of the board are residents of Toledo. The only representatives of the New York and Chicago bank creditors left on the board are J. R. Harbeck and Elisha Walker of this city.

The fact that control of the company has been shifted to Toledo is evidenced by the announcement that the executive offices which have been maintained in New York for years will be removed to Toledo and that John N. Willys, president of the company, will devote practically all of his attention to Willys-Overland. When he is not on the road promoting sales he will be at Toledo.

The significant announcement also is made that Willys has severed connections with practically all his other interests. While official information on the subject is lacking, there is reason to believe that this means his early retirement from the Republic Motor Truck Co., of which he has had control, but which now is virtually in the hands of its creditors.

Wilson Chosen General Manager

No definite date has been fixed for closing the executive offices here and little is known about what will be done with the personnel of the New York organization. It is assumed that all the officers of the company will be taken to Toledo.

Another important development in the affairs of the company was the election of Charles B. Wilson, who has been vice-president in charge of operations at Toledo, as general manager. He thus succeeds Walter P. Chrysler as the most powerful influence in the company next to Willys himself.

Wilson is very highly regarded by the Toledo directors, and he was made general manager at a meeting which was not attended by Willys, who is absent on a long trip.

Extension of the bank notes for three months is something of a surprise. It was reported in AUTOMOTIVE INDUSTRIES last week that the new directors had been given 30 days in which to consider the bankers' refinancing program. The Toledo bankers, who would be glad to take over all the bank indebtedness if they could do so, are said to favor a continuance of the policy under which the loans have been reduced by 10 per cent payments in cash from time to time, and it is believed they will insist upon this plan.

Company's Assets, $100,000,000

The following statement in reference to the affairs of the company has been made by Willys:

Willys-Overland has assets exceeding $100,000,000. In addition to its Toledo plant, devoted exclusively to manufacture of Overland and Willys-Knight cars and parts, there are three other plants located in Pontiac, Mich., Elmira, N. Y., and Elyria, Ohio.

We have $78,670,381 paid-in capital stock, $22,049,500 of which is preferred and $56,620,881 common. There never has been a bond issue. It has been company's policy to provide part of its working capital by borrowing from banks. Notes payable have been as high as $34,465,000 and are at present $16,556,000. Company has $4,000,000 cash in banks and is meeting all its obligations.

Operating condition is splendid, principally because it has consumed its high-priced material inventory and practically eliminated its obligations for high-priced material.

We are entering a selling season with every reason to expect big business. We have put into operation an improved marketing plan. More than 3500 live dealers have contracted with us, and early this spring we hope to have at least 5000 dealers.

There is no mystery surrounding our financial position, and we fully expect that before the spring season is over the progress we are making will place Willys-Overland in the strong position which facts in the case justify.

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SPAIN TO INVITE U. S.

NEW YORK, Feb. 27—A dispatch from Madrid says that Foreign Minister Hontoria is about to send official invitations to the United States, British, French, Belgian, German, Austrian, Italian and Swiss governments to participate in the International Motor Car Exposition at Barcelona. The exposition will take place some time in May.

Klingensmith, Beall, Hanover to Build Cab

Nat Jacoby Associated in New Company—Separate from Gray Organization

DETROIT, Feb. 28—A company capitalized at $10,000,000 soon will be incorporated in New York State to manufacture a standard taxicab, which will sell for approximately $1,200.

Identified with the new enterprise will be Frank L. Klingensmith, president of the Gray Motor Corp., and Frank F. Beall, his associate in that company; H. T. Hanover, president of the Apex Motor Corp., and Nat Jacoby, who is now at the head of the Black and White Cab Co. of New York.

The new corporation will be entirely separate from Gray Motors.

Plant Located

The plans as outlined call for a vehicle from which will be eliminated all unnecessary equipment and attachments. The cabs will be manufactured and operated by the company. A plant already has been located. The operating end of the business will be under the direction of Jacoby.

Connected with the new enterprise will be four automotive engineers who have made a careful study of the taxicab question. It is understood that the vehicle will be an engineering product rather than an assembled one. Operations eventually will be carried on in all the large cities if the plans of the corporation mature.

Control of Guy Disc Valve Engine Acquired

DETROIT, Mar. 1—Frank L. Klingensmith and his associates in the Gray Motor Corp. are reported to have acquired control of the Guy Disc Valve Engine Co. of Ypsilanti, which formerly was a part of the Apex Motor Corp., manufacturers of the Ace car.

Originally the Apex company made both the car and the engine, but because of lack of manufacturing facilities its plant was used exclusively for making the car, which was equipped with a Continental engine.

The original plan was to manufacture the Guy engine in two types, one of four cylinders and one of six. It now is believed that the four will be used for the Gray car and the six for the Ace and the new taxicab which will be built by Klingensmith and his associates.

Harry T. Hanover, president of the Apex company, is also interested in the taxicab corporation, it is understood.

Truck Gain Shown in Growing Output

Improvement Noted in Car Business, Especially in $800 to $1,000 Price Class

By JAMES DALTON

NEW YORK, Feb. 28.—The coming of March brings reports that factories in the Detroit district are preparing to speed up production. Sales have increased to a point where it is difficult to fill orders on the present part-time basis and several plants will add a day or a day and a half to their working week.

Better business is felt particularly by the companies making cars in the $800-$1,000 price class, but Cadillac and Lincoln both declare they have orders booked far ahead. The Lincoln Motor Co. has just awarded a $1,000,000 contract for 4- and 7-passenger body models. The Gray Motor Corp and the Rickenbacker Motor Co. have placed large orders for supplies and are preparing to go into production. Other companies are releasing materials earlier than had been expected.

Greater Stress on Fuel Saving

At least two prominent passenger car manufacturers are preparing to bring out new models. It is freely predicted that before the year is over greater stress will be placed on gasoline economy and less on the initial price. High mileage per gallon of gasoline will be one of the talking points for the $348 assembled car which W. C. Durant has contracted to build.

Evidence of the increased demand for light delivery trucks is found in the fact that 1000 more Reo speed wagons were sold in January than were produced at the factory. Substantial gains also were made in January by makers of heavy-duty trucks.

Dealers Show Confidence

The optimism of manufacturers probably is a reflection of the increased confidence of dealers in all parts of the country. Reports from shows everywhere tell of more sales at retail than last year and greater interest by the public. Everything points to a substantial spring business, both in passenger cars and trucks. Unusually mild weather already has roused the motoring urge.

Business of parts and accessory manufacturers in January was materially larger than in December and the indications are that February was still better. They are now feeling the full benefit of deflated inventories. Even machine tool makers are having inquiries from vehicle manufacturers who see the need of putting their factories in better position to meet keen competition.

Production of pneumatic tire casings for 1921 reached the unexpectedly large total of 21,820,041, but there are no accurate figures for 1920 with which to make comparisons. It was little, if any, larger in that year, however.

Those companies which really are going after export business are getting it. Sales are being made in steadily increasing volume in Australia, Argentina, Mexico, Porto Rico, South Africa, India and Scandinavia. The tone of the market is better in Cuba, Porto Rico, the Philippines and other small countries. The General Motors Corp. is shipping an average of 125 Buicks and Chevrolets daily from Oshawa, Ontario, and all exporters have been heartened by the recent rise in exchange.

Both domestic and foreign sales for the first two months of the year have been so far ahead of the same period in 1921 that there is danger of rousing exaggerated expectations for the remainder of the year, but the difference in volume will grow smaller as the year progresses.

No Change in Bosch Force Following Kern's Leaving

SPRINGFIELD, MASS., Feb. 27—Arthur T. Murray, president of the American Bosch Magneto Co., declared emphatically to-day that no further changes in the organization were in prospect as a result of the cabled resignation of Martin E. Kern as a director, which was received last week.

Kern, a former Allentown, Pa., banker and organizer of the Bethlehem Motors Corp., figured prominently in the purchase of the Bosch property from the alien property custodian. This sale is being investigated by the Department of Justice. Kern is now abroad.

Murray said he did not know whether or not Kern had disposed of his stock holdings in the company, but asserted that they were not large. He added that the affairs of the company were progressing satisfactorily and that a steady increase is being shown in the volume of business.

SENATE GETS HIGHWAY FUND BILL

WASHINGTON, Feb. 25 — Senator Standfield of Oregon has introduced a bill to extend and carry out the provisions of the Federal Highway Act, providing for an appropriation of $100,000,000 for each fiscal year from 1923-1927, to aid the States in the construction of rural post roads and other purposes.

Wholesale Business for Lincoln Dropped

Sales Will Be Handled Through Dealers—Ford Executives to Co-operate at Plant

DETROIT, Feb. 25—Completed plans for the distribution of Lincoln cars by the former Lincoln dealer organization and the Ford dealer organization find wholesale business eliminated, all transactions with retailers now being handled directly through the Lincoln factory here or through the 35 Ford factory branches.

Dealers in the metropolitan cities of the country do business directly with the factory, carrying their own stocks of cars and parts. In the smaller cities of the country the Lincoln dealers will deal with the nearest Ford branch and will carry small stocks of cars and parts. In the rural districts the Ford dealers will sell Lincolns on commission, getting their cars from the branches as they sell them, but carrying no parts.

Dealers Work Together

In the cities where there are both Lincoln and Ford dealers, the latter will for the most part act as salesmen for the Lincoln, commissions being fixed to make this attractive. All servicing and the handling of trade-ins involved will be by the Lincoln dealer. Where the Ford dealer would handle the sale and trade-in, a large commission is provided.

Production at the factory will be under the co-operative direction of Lincoln and Ford executives, Wilfred C. Leland, general manager, said to-day. It is not expected to name a new production head specifically for Lincoln he said. This same co-operative idea applying to sales and production has been worked out to apply to every department of the two companies, he stated.

The impression that Ford would dominate the new Lincoln organization and that Ford men would be installed to take over the active management of affairs has not been borne out. All inquiries at the offices of Henry and Edsel Ford as to Lincoln affairs have been referred to Wilfred C. Leland, and any official information on developments has come exclusively from him.

To Amalgamate Plants

One of the first steps of the reorganized company is to amalgamate the Holden avenue plant with the main plant. This step was contemplated before the receivership and is now being put into effect. The Holden avenue plant formerly embraced the screw machine and frame departments. These are now being fitted into the scheme of progressive manufacture at the main plant and will result in large annual economies. As soon as all equipment is moved, the Holden avenue factory will be offered for sale.

Production will be increased so that by March 15 it will reach 30 a day. This rate will be continued until a sufficient

(*Continued on page* 540)

United Auto Stores Put in Receivership

Similar Application Filed Against Subsidiary—President Claims Company Is Solvent

PHILADELPHIA, Feb. 24—The United Auto Stores, Inc., a chain system of tire and accessory stores, incorporated in Delaware but having its headquarters here and operating fifty-eight branches in four states, has been thrown into receivers' hands. The United Guaranty Corp., organized to sell stock in the United Auto Stores, will soon follow, if an application made in the United States District Court is granted. Steps are being taken to have receivers appointed in every state where the two organizations do business. A deputy sheriff now has charge of the office of the Guaranty company here.

Receivers Make Application

The application for the second receivership was made in the name of Francis F. Burch, a councilman of this city, and Major Samuel A. Whitaker, the temporary receivers named to take over the affairs of the United Auto Stores. The liabilities of the Stores company are stated to be $1,250,000 and the assets are asserted to be in a much tangled condition. Book assets are given as $4,000,000. Actual assets are said to be $281,000 in merchandise and stock in a local foundry.

Attorneys for Edward B. P. Carrier, the president, have issued the following statement:

Edward B. P. Carrier, head of the United Auto Stores, Inc., and also president of the United Guaranty Corp., declares the company is absolutely solvent. It has fifty-eight stores in active operation and the good will of thousands of customers. He closed the stores which were dead wood.

The branch at 131 South Broad Street was closed to reduce overhead expenses. Up to the time that a receiver was appointed no creditor had filed a petition in bankruptcy and no stockholder had filed a petition for receivership.

Some adverse business interests, it seems to Mr. Carrier, are engaged in deliberately conspiring to embarrass him and the company and to seize the company. The company's affairs are embarrassed solely by the financial depression and a dull season in the sale of automobile accessories and had it not been for the business enemies of Mr. Carrier the company would quickly be put on a sound footing.

Carrier Owns Most Voting Stock

Carrier, who is 28 years old and who started in business a few years ago in the tire sales and repair line, is said to own 490 of the 500 voting shares of the Stores company. His attorney also states that $50,000 liabilities recently had been cancelled.

In the opinion of A. E. Williamson, expert accountant, about $3,750,000 which is valueless is charged in with the assets. He reports that the concern had heavy overdrafts at local banks.

Joseph L. Kun, assistant United States Attorney, whom Williamson is assisting and who is going over the companies' affairs, asserts that there was an operating loss of $1,000 a day on accessories and a net deficit of more than $1,000,000. Kun also asserts that the company lost $1,385,770 from December, 1919, until the present. The Stores company, which had been operating a short time prior to 1919, was recapitalized for $1,000,000 in September of that year. The Guaranty company was not formed until April, 1921.

Kun Says Large Profit Made

According to Kun, during the stock increase of the Stores company in 1919, Carrier, through the Guaranty company, underwrote 40,000 shares of common stock at $1 a share and then sent his salesmen out and sold the stock for $42 a share, and returned the sum of $1 to the Stores company and the balance he retained after paying commission to the salesmen. Kun states that agents in charge of Stores company shops were required to buy $2,000 worth of stock each.

The United Guaranty Corp., it is said, had a contract to sell United Auto Stores, Inc., stock for $50, receiving a commission of $26 a share. This gave the chain stores $24 out of every share sold to go into the treasury. More than 160 stock sales men of the corporation are reported stranded in various cities throughout twenty states, and many have appealed for funds to the local District Attorney's office. The agents for the corporation, it is said, were also employed by Carrier to promote the sale of stock in the Hydro-United Tire Co. of Pottstown, Pa. This fiscal agency is said to have sold through its corps of salesmen $2,392,280 worth of Stores company stock to between 10,000 and 11,000 men and women, chiefly residing in the East.

New Jersey fishermen are reported to have been heavy purchasers of stock in the Stores company. Many of the employees also were stockholders. Stock purchasers in Reading, Pa., where the

(*Continued on page* 541)

Voorhis Directs Nash Sales; McCarty, Manager

KENOSHA, WIS., Feb. 27—Charles B. Voorhis has been appointed vice-president and director of sales of the Nash Motors Co., and Earl H. McCarty, formerly assistant sales manager of the Studebaker Corp., has been appointed sales manager.

McCarty joined the Studebaker organization in October, 1902, when he was just out of school. After occupying various positions in the sales department he was appointed manager of the Portland branch of the vehicle division in 1914 and a year later was transferred to Dallas, Tex., in a similar capacity. In 1917 he was taken into the automobile division, going back to Portland as assistant branch manager. Eight months later he was promoted to branch manager and in 1919 was called to South Bend to become assistant sales manager.

New Stock Provided Under Midwest Plans

$4,500,000 Preferred Will Be Held by Creditors—Working Capital to Be Obtained

INDIANAPOLIS, Feb. 25—Plans for the reorganization and refinancing of the Midwest Engine Co. of this city have been announced by Oscar Stevens of New York, secretary of the creditors' committee of local and outside banks that have had charge of the management of the organization since July 17, 1921.

The plans in brief call for the reorganization of the company into the Midwest Engine Corp.; issuing of $4,500,000 of preferred stock which will be held by the creditors of the Midwest Engine Co.; issuance of 125,000 shares of common stock; 75 per cent of which will be awarded to share holders of the preferred stock of the Midwest Engine Co.; and flotation of $3,000,000 of 7 per cent refunding bonds, of which but $1,000,000 are to be sold immediately and to be applied solely as working capital of the reorganized concern.

Stockholders Approve Plan

One-half of the bonds to be issued now are said to have been subscribed for by holders of preferred stock, and the balance is to be placed with present share holders. About $1,200,000 of the bonds are to be held in the treasury to provide for the refunding of the present issue, and $800,000 will be used to satisfy claims of bank and trade creditors. It it said that 85 per cent of the holders of preferred stock have approved of the reorganization plans.

It is believed that the reorganization plan will not affect the personnel of the company and that John Wood will continue as manager. The company is said to have engine contracts with the makers of truck, tractor and bus companies that with normal conditions might run to $2,000,000 worth of engines a year and that there are prospects of additional contracts that might double this demand under normal requirements.

Voting Powers Depend Upon Dividends

Under the reorganization plan, the holders of the common stock of the Midwest Engine Co. are to drop out of the organization as far as their holdings are concerned. Holders of the new preferred stock will be given voting powers in the corporation after the concern has paid dividends for two consecutive years.

S. A. E. MEETING IN JUNE

NEW YORK, Feb. 27—The Society of Automotive Engineers will hold its 1922 summer meeting at White Sulphur Springs, West Virginia, June 20 to 24. There will be the usual sports and entertainment in addition to the technical program. The S. A. E. expects to get a round trip railroad rate of a fare and a half for the convention.

Dirigible Airship Line to Be Opened

General Air Service Will Operate Craft Like Zeppelins and Use Helium

WASHINGTON, Feb. 27—The General Air Service has been incorporated in Maryland as a successor to the American Investigation Corp. which was organized to investigate the practicability of establishing in this country a commercial dirigible air service. Plans for establishing this service and details of the preliminary investigation were recounted in AUTOMOTIVE INDUSTRIES of Aug. 11 last.

Crowell an Incorporator

Benedict Crowell, former assistant Secretary of War, who headed the American aviation mission to Europe and who is president of the Aero Club of America, is one of the incorporators of the General Air Service. Other men associated with him are: L. V. Benet, president of the Hotchkiss Co.; Owen D. Young, vice-president of the General Electric Co., New York; Marshall Field, 3rd; Col. Charles DeForest Chandler, U. S. Army, retired; Snowden A. Fahnestock; E. M. Herr, president of the Westinghouse Co.; Samuel McRoberts; R. B. Mellon of the Mellon National Bank of Pittsburgh; Theodore Pratt of the Standard Oil Co.; Franklin D. Roosevelt; Benjamin Thaw of Pittsburgh and David Goodrich of New York.

Dr. Johann Schuette of the Schuette-Lanz Airship Co. will be associated with the new corporation. The incorporation papers were filed two weeks after Dr. Schuette returned to the United States. Negotiations with the Zeppelins are understood to have been dropped definitely, but the type of airship which will be used will be similar to the Zeppelin.

New York to Chicago First

Promoters of the company say that the first line to be put into operation will be from New York to Chicago, and that it will be extended to the Pacific Coast when additional ships have been built. Preliminary operations will be begun with two ships, which will be fabricated in Germany but assembled in the United States. They are designed to provide accommodations for 100 passengers and 30 tons of mail and express matter.

The company proposes to use helium instead of hydrogen gas in the operation of dirigibles, which will embrace the latest modifications of both the Zeppelin and Schuette-Lanz patents. It is asserted also that gasoline, another source of fire and explosion, will not be used and that the motor power will be furnished by oil fuel.

Promoters of the company believe that the government will permit the use of the navy hangar at Lakehurst, N. J., or at Cape May for the assembling of the dirigibles while its own housing and terminal facilities are under construction. Careful consideration has been given to sources of helium supplies, and the government is deeply interested in this question.

"Our aim is to supply dirigible airship service to America," Crowell said, "and as time goes on to link this continent with the rest of the world by aerial routes, a service supplementing existing methods of transportation, one which will traverse space in a minimum of time and supply a means of travel both safe and comfortable."

Court Finds Burdick Tire Assets Exceed Liabilities

INDIANAPOLIS, Feb. 24—Judge Anderson in Federal Court here has denied the petition of alleged creditors of the Burdick Tire & Rubber Co., a Delaware corporation with a factory at Noblesville, Ind., that the company be thrown into bankruptcy and a receiver appointed. Judge Anderson declared that the testimony showed the corporation has assets in excess of its liabilities. He added, however, that it was evident some of the stockholders had been "flim-flammed."

The petition was filed some time ago by Calvin C. Miller and Joseph Lowman of Peble County, Ohio, creditors of the tire company, who charged mismanagement of the company, insolvency and efforts to defraud stockholders.

Root and Pavey Become Officers in Parts Firm

COLUMBUS, OHIO, Feb. 27—The Automotive Parts Co., capitalized at $250,000, has been organized by Columbus capitalists to operate a wholesale business in parts and accessories. H. C. Root, for the past eight years general manager of the Westcott Motor Car Co., is president; Ernest E. Pavey, receiver for the Monitor Motor Car Co., is vice-president. Root will also be general manager of the business.

The concern will have exclusive selling rights in Ohio for Continental Motors, Timken axles and bearings, Warner transmission systems, Borg & Beck clutches, Spicer universal joints and other parts. The headquarters will be in this city.

GILSON BUYS GLOBE PLANT

MILWAUKEE, Feb. 27—Harry W. Bolens, president and general manager of the Gilson Manufacturing Co., Port Washington, Wis., has purchased the plant and equipment of the defunct Globe Metal Products Co. of Sheboygan, Wis., at receiver's auction, for $65,700. The property consists of a foundry and machine shop. The Gilson company manufactures gas engines, farm implements, tools, etc., and recently developed a power hoe and lawn mower tractor, which, it is said, probably will be placed in production in the former Globe works. The implement is a combination cultivator and lawn mower and sells for $180.

"Pittsburgh Plus" First Hearing Held

Steel Corporation Seeks to Show Consumers Prosper Despite Alleged Handicap

MILWAUKEE, Feb. 27—The Federal Trade Commission has just completed the first of the series of hearings it will conduct in various steel consuming centers of the West upon its complaint against the United States Steel Corp. and its subsidiaries, seeking the abolition of the alleged practice of selling rolled steel material on a Pittsburgh base and charging freight from Pittsburgh to fabricators' plants, regardless of the point of origin of the shipment. The practice is commonly known as "Pittsburgh Plus."

The testimony of witnesses generally aimed to show that western fabricators are unable to compete with competitors east of Chicago in the eastern territory, because shops located nearer Pittsburgh than Milwaukee are able to lay down products cheaper because of the advantage of freight rates.

Rates Higher to Milwaukee

The freight rate from Pittsburgh to Milwaukee is 41.5 cents per 100 lbs., while it is much less from Pittsburgh to Cleveland, Detroit, Cincinnati, Indianapolis, Toledo and other competitive points, so that competitors at these points, due to the Pittsburgh basing point practice, are able to acquire their raw steel at a lower cost than Milwaukee or other western plants must bear.

Since Milwaukee is one of the leading centers of the automotive parts industry, and the passenger car as well as motor truck industries are centered largely in points east of Chicago, the effect of "Pittsburgh Plus" as brought out at the hearing was shown to be particularly disadvantageous to manufacturers of this class of rolled steel product of a standard character. On patented articles the disadvantage was shown to be less severe because of the obvious fact that manufacturers of patented articles have more definite control of selling prices on such goods than on standard articles.

Counsel for the Steel corporation laid emphasis on the fact that the hundreds of invoices, purchase orders and letters of quotation introduced into the record by Milwaukee consumers invariably showed that sales were billed f.o.b. Milwaukee, to prove that there is no Pittsburgh basing point in existence. Their cross examination of witnesses usually followed the line of drawing out testimony to show that Milwaukee consumers have prospered and grown in a normal way despite any handicaps they might claim they were under.

CONCENTRATES ON 8 H.P. TALBOT

LONDON, Feb. 20 (*by mail*)—The S. T. D. Co., maker of Sunbeams, Talbots and Darracqs, is concentrating on the output of the light 8 h.p. Talbot.

Seeking Way to Deal with Dunlop Assets

English Director Comes to America on Investigation, Szarvasy Tells Stockholders

LONDON, Feb. 20 (*by mail*)—The following statement in reference to the American Dunlop Co. was made by F. Alexander Szarvasy, chairman of the board, at a recent meeting of shareholders:

"In accordance with the program outlined to you at the last annual general meeting, we made an offer to the Dunlop American Pool Certificate holders of two Dunlop Ordinary shares for every three pool shares, and, as shown in the report, our company now holds, including the £1,000,000 invested by ourselves some time ago, a 96½ per cent interest in the equity of the American company.

Large Sum Owing

"In addition, the American company owes us on open account £806,000, our total investment at the date of the account thus being approximately £3,780,000 to which must be added the £560,000 advanced last month."

He stated further:

The American company created in January, 1920, a one year bond issue of $6,000,000 guaranteed by ourselves, of which $4,545,000 were placed and a further $600,000 were used as collateral security against advances from local banks. These bonds were held partly by a number of trade creditors of the American company, partly by local bankers, and partly by firms and individuals in this country who are largely interested in this company.

We made arrangements last month with our bankers whereby the whole of the bonds held by creditors in America was purchased from them for our account at a cost of approximately £560,000, and we succeeded in making arrangements with the local bankers in America, and with the holders of the bonds in England, to postpone the date for the repayment of their bonds for a period of 12 months. Our own holding of these bonds, therefore, is now more than 50 per cent of the total, and we have 12 months before they become due, within which we can deal with the assets at our leisure.

Three Suggestions Made

There appear to be three ways of dealing with these assets. First, by making arrangements with banking interests in America for effecting the finance—this would involve raising $12,000,000 to $14,000,000 in order to repay the existing bond issue, provide working capital, and enable the works to be started on a moderate program of production, and, if trade conditions permitted, to gradually work up to the full production program of 44,000 tires per week.

This plan has proved to be unattainable for the moment. My colleague, Mr. Tait, made a special journey to America in October last in order to explore all the possible channels, and he was successful in inducing two very important firms of bankers to consider the proposition. They arranged to send their expert over here to investigate the position of the home company, whose guarantee, as an essential condition, was to have been attached to the bonds proposed to be issued in America.

I have not seen the report of this expert, but I am informed on good authority that the report was quite favorable regarding our position here, and I may tell you that I had a long interview with this gentleman and found him greatly impressed with the thoroughness with which we were carrying through our internal reorganization, and with the manner in which we dealt with all our difficult problems.

I am confident, therefore, that the reason why this permanent finance was not carried through must be looked for in the general conditions of the tire trade and in the prevalent disorganization of industry in America. We all know that America is suffering even more severely than we, owing to the trade depression, and the latest statistics show that the largest American tire companies are only operating up to 60 to 70 per cent of their capacity.

In this respect, therefore, our prospects for turning the large amount we have invested in the American enterprise to a profitable use is delayed for the time being.

The other way of dealing with these assets would be by realizing by way of sale, and here the value of the property is naturally of the utmost importance. The actual amount of money spent, directly and indirectly, on this asset is approximately £6,000,000; therefore, considerably more than the figure at which it stands in our balance-sheet. Neither must we lose sight of the fact that this investment includes a cotton mill, which is operating today at its full capacity, and is a valuable asset.

The third and most promising avenue seems to be in a combination with existing interests in America, and in order to see how far we can proceed on this line, one of your directors, Mr. Proctor, has just left for America. He was out there a year ago, and is fully conversant with all the circumstances so that we are hopeful as to the success of his mission.

Seiberling to Introduce New Tire to Public April 3

AKRON, OHIO, Feb. 27—The new Seiberling cord tire, perfected by F. A. Seiberling and now being manufactured by the Seiberling Rubber Co., of which he is president, will be formally introduced to the American motoring public during the week of April 3.

The Seiberling company expects to sign up 1000 dealers scattered throughout the United States by that time and to hold a simultaneous Seiberling dealers' opening week. The same window display will be used during the week by all Seiberling dealers.

Combined production of the two Seiberling plants, at New Castle, Pa., and Barberton, Ohio, including the Seiberling tires and the old line of Portage cords and fabric tires, now exceeds 800 daily.

Sandusky Syndicate Buys Maibohm Motors

TOLEDO, Feb. 28—A syndicate of Sandusky business men has purchased the assets of the Maibohm Motors Co. subject to the approval of the creditors. The purchasers hope to go forward under the present plan of operation. The creditors' committee believes consent of the stockholders to the sale may be obtained soon.

Bigger Output, Plan of G. M. of Canada

New Schedule Calls for 175 to 200 Cars Daily—Plants on Full Time

OSHAWA, ONT., Feb. 27—Plants of General Motors of Canada, Ltd., at Oshawa and Walkerville, are operating full time, and a number of the departments are working overtime in the production of the McLaughlin-Buick, Chevrolet, Oldsmobile and Oakland motor cars. The daily output for the past three months has been 150 finished automobiles, and the schedule for the next two months calls for a daily output of from 175 to 200. This will be the largest schedule in the history of the Canadian company.

The payroll for the month ending Feb. 15 was at the rate of $440,000 a month. The reason, of course, for the size of this payroll is that very few parts are brought in from the United States. It is an established policy of the company to manufacture every possible part of the car from Canadian material and with Canadian labor.

President R. S. McLaughlin is optimistic with respect to Canadian business. The past three months have seen a healthy increase in the domestic market for motor cars.

Production schedules for the various units have been arranged to take care of an increased home demand, as well as the large foreign demand. The fact that General Motors factories are running to capacity to supply Canadian and overseas business has enabled them to distribute overhead expenses, thus effecting economies represented in recent substantial price reductions. Canadian purchasers of General Motors products in this way secure a direct advantage as a result of the big production, made necessary by export demand.

Yeomans Named Receiver for Illinois Body Company

DANVILLE, ILL., Feb. 27—Victor Yeomans has been appointed receiver for the United Automotive Body Co. which operates a plant at Tilton near this city. Judge English of the Federal Court made the appointment following the presentation of a petition from a committee of creditors. The corporation was formed in Delaware, but, it is said, had not been authorized to do business in Illinois.

It is understood that the company was merely a sales organization for the parent company, the L. C. Graves Corp., located in Lansing and Detroit.

The question of ownership of three carloads of finished bodies and supplies has not been settled, but claim has been filed by the creditors here on the grounds that the corporation has no standing in Illinois and that they were consigned simply to the local branch. Receiver Yeomans has taken charge.

Seek Lincoln Data from War Department

Attorney General Conducting Inquiry Into $6,000,000 Claim Filed by Government

WASHINGTON, Feb. 28—Attorney General Daugherty to-day advised AUTOMOTIVE INDUSTRIES that Assistant-to-the-Attorney General Goff is conducting an inquiry into the affairs of the Lincoln Motors Co. to determine the effect of immediate prosecution of the Government's claim for $6,000,000 against the Detroit Trust Co. as receiver. Senator Townsend of Michigan and James Murfin, attorney for the creditors, advised the attorney general that pushing this claim would prove disastrous for many business men and banks who are creditors of the Lincoln company.

Mr. Daugherty stated that he was also investigating the grounds upon which the War Department bases its charges. He stated that the questions at issue involve matters of taxes, manufacture of motors, and other details which he refused to make known. The attorney general insisted that nothing definite could be given out at this time until the Department of Justice had reached its own conclusions on the representations made by the War Department. Murfin conferred with the attorney general personally on last Friday, relative to the claims of creditor banks and merchandise creditors and set forth their position.

It was indicated by Mr. Daugherty that the matter hinged on changes in contracts with the Government.

Sale in Delaware

WILMINGTON, DEL., March 1—The patents, rights, interests in patents and applications therefor; trademarks, trade names and all interests therein; bonds, obligations, bills of lading shipping, receipts, promissory notes, drafts and accounts receivable, as well as all other rights or causes of action arising upon contracts or from the alleged unlawful taking or detention of, or injury to property of the Lincoln Motors Co., and also the corporate franchise of the company, were sold here yesterday by the receivers to George B. Perry of Detroit, Mich., for $10,000.

Whom Perry represented could not be learned, but it was believed here he represented the Ford interests. The property sold was that of the company held to be in the jurisdiction of the United States District Court for Delaware.

Aeronautical Chamber Elects Its Governors

NEW YORK, Feb. 28—An annual aeronautical institute conducted by and for engineers and designers to exchange thought on the scientific development of aviation has been proposed by Samuel S. Bradley, temporary president of the Aeronautical Chamber of Commerce. The organization also will promote flying meets, demonstrations and aeronautical shows in addition to co-operating with the various departments and bureaus of the Government.

The following governors have been elected by the membership: C. C. Witmer, president of the Airship Manufacturing Co.; Frank H. Russell, vice-president, Curtiss Aeroplane & Motor Corp.; John M. Larsen, president, J. L. Aircraft Corp.; Grover C. Loening, president, Loening Aeronautical Engineering Corp.; Samuel S. Bradley, general manager, Manufacturers Aircraft Association; F. B. Rentschler, president, Wright Aeronautical Corp.; B. E. Bushnell, director of sales, Stewart Hartshorn Co.; Charles H. Colvin, general manager, Pioneer Instrument Co.; Sherman M. Fairchild, president, Fairchild Aerial Camera Corp.; Lawrence Sperry, president, Lawrence Sperry Aircraft Corp., and Charles F. Redden, president, Aeromarine Sales & Engineering Co. and Aeromarine Airways, Inc.

Court Fixes Upset Price for Sale of Pan-American

DECATUR, ILL., Feb. 29—Judge Baldwin in the circuit court has issued an order for the public sale of the Pan-American Motors Corp. Edward Danner, president and receiver, denied that the corporation was insolvent and that efforts of the directors to dissolve the company were unsuccessful because they lacked the necessary two-thirds vote.

Judge Baldwin ordered the receiver to obtain at least 75 per cent of the inventory value in selling the chattel property. The inventory shows the net value of the corporation to be $313,835. Of this $21,479 is in notes given in payment for common stock and $2,172 for preferred. It is estimated that holders of common stock will realize twenty cents on the dollar, while holders of preferred will receive the full par value of $10 per share.

There are 34 finished motor cars, valued at $37,000, and other supplies totaling $154,000. Service cars, trucks, machinery, tools and equipment are estimated at $22,000 more. A mortgage on the real estate of $81,000 is held by a local bank.

FRENCH LOOK TOWARD IRELAND

LONDON, Feb. 20 (*by mail*)—The value of motor vehicles imported into Ireland increased from $4,200,000 in 1919 to $15,000,000 in 1920. The formation of the Irish Free State has caused French manufacturers to realize the value of this market, and a campaign is to be launched with a view to creating demand for French products.

BUS HOLDS 51 PERSONS

OTTAWA, ONT., Feb. 27—The Ottawa Car Manufacturing Co. has completed the first motor bus for the Toronto Transportation Commission. Accommodation has been provided for 51 persons, the second deck being reached by means of a stairway leading from the rear platform.

Full Time Program Growing in Detroit

Factories Increase Production Incident to Steady Improvement in Business Conditions

DETROIT, Feb. 27—Steady improvement in business conditions during the week has found a number of Detroit manufacturing companies going upon full time schedules for the first time this year. Notable among these is the Maxwell Motor Corp., the demand for whose new line is running higher weekly, with consequent stepping up almost daily in the number of cars manufactured.

Maxwell is working steadily toward the improvement of service conditions and has several plans toward this end under contemplation. It is probable that a number of factory controlled service stations will be located in important cities of the country, so that owners may never be more than a few hours away from genuine replacement parts.

Ford Orders Increasing

Ford Motor Co. has not entered upon a full time manufacturing schedule yet, but orders are reported steadily increasing and full time probably will start early in March. Dodge Brothers is working at full capacity, the schedule being approximately 600 cars daily.

Though Ford officials deny the probability of the early announcement of a new Ford truck of 2 to 3-ton capacity, it is not denied that the company has a new truck fully developed which is to be introduced. Only market conditions are considered to be keeping the new vehicle under cover. A betterment in general business conditions by the late spring or early summer probably will lead to an announcement then.

Reo Motor Co. has improved its line by adding many refinements, among which are new fenders and a new frame, drum type headlights and polished aluminum dashboard controls and finishings. The cars thus equipped were not shown at either of the two national shows.

6000 Jewetts by July 1

Jewett Motors will go into production March 10 on its phaeton model and will build about 500 the first month. This production will be increased to about 1800 in April and will continue at that number until July 1, by which time 6000 cars will be completed. A new schedule will be laid out at that time.

The company will confine its building operations to the phaeton for the first few months and will start the sedan about May 1. The other models, roadster and coupe, will be added later. The phaeton is priced at $1,065 and the sedan at $1,395. Prices on the other models have not been fixed.

Manufacturing of the Jewett line will be carried on at the Paige factories. Two new assembly tracks will be laid out for

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Full Time Program Growing in Detroit

Factories Increase Production Incident to Steady Improvement in Business

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the Jewett line. There is sufficient room at the factory for both Paige and Jewett production in 1922, according to factory engineers. Forty thousand dealers will be circularized on the new Jewett line this week.

Dort Motor Car Co. has been given permission by the Michigan Securities Commission to sell 25,000 shares of no par value common stock at $20 a share. In granting the stock issue, all outstanding stock of the company, which heretofore has been practically a closed corporation, was ordered escrowed with the commission. This includes 45,067 shares in the hands of F. A. Aldrich, as trustee, and 125,000 other outstanding shares, including 2100 shares deposited with Flint banks as collateral. The trustees' stock, the property of J. Dallas Dort and F. A. Aldrich, which was issued for the assets of the old Dort Carriage Co. at the time of the organization of Dort motors, was ordered turned into the treasury of the company as a gift, making 75,000 shares in the treasury.

Rickenbacker Motor Co. is now producing 10 cars daily and has contracts with 25 distributors. The company is selling $3,000,000 of its authorized $5,000,000 common at $10 par. Two hundred thousand shares went to the promoters in consideration for development work and property turned over to the new corporation. Experimental work is estimated to have cost $450,000. Half of the $2,000,000 stock issued for development, plant, etc., and held by the officers is in escrow with the Michigan state treasurer until the company has earned 6 per cent on all stock outstanding for a year.

Stevenson Installs Plant

DETROIT, Feb. 28—The Stevenson Gear Co. will install a plant for the manufacture of gears by its multiple shaper method in the factory of the Michigan Pattern Machine Co. Substantial orders are reported from a number of companies, and production will be started at once. By its lease the company will have the use of $200,000 worth of machinery, in addition to its multiple shaper equipment.

SHEFFIELD WORKS CLOSED

LONDON, Feb. 20 (*By Mail*)—The Sheffield works of the Sheffield Simplex Motor Car Co., in which Earl Fitzwilliam holds a predominating interest, have been closed, because production is in advance of sales. The manufacture of cars, motorcycles and commercial vehicles has been continued until all the storage accommodation is occupied.

Business Better!

SOUTH BEND, IND., Feb. 24—From Jan. 1 to Feb. 10 the Studebaker Corp. of America manufactured 10,683 cars, as compared with 3528 in the same period a year ago. Production for the month of January was 7243. Studebaker expects during 1922 to produce 93-000 vehicles, as compared with 68,-000 in 1921 and 53,000 in 1920.

The New York City area shows the largest increase in business over a year ago, the increase being 135 per cent. Boston has an increase of 84 per cent, and the Philadelphia territory, 61 per cent. Studebaker production is running on a basis of 40 per cent among the three models of Light Six; 40 per cent Special Six and 20 per cent Big Six.

DETROIT, Feb. 25—The Packard Motor Car Co. is selling about 25 per cent more trucks than in the same period last year. Among the purchasers are large business organizations which have just come into the market, and a substantial truck replacement business is expected by Packard this year. There also are indications of an increased demand for trucks in highway construction, as well as in the passenger transport business.

ELGIN, ILL., Feb. 25—The Elgin Motor Car Corp. reports that its shipments for January were 200 per cent better than for December and that February shipments have been 35 per cent better than January. The production schedule for March calls for 300 cars. The company recently has closed contracts with five large exclusive distributing organizations and seven direct dealers.

DETROIT, Feb. 27—The Ford Motor Car Co. of Canada has increased its manufacturing schedule to 5 days a week of 8¾ hours each. It is turning out 218 cars a day. There also has been an increase in the parts business.

CLEVELAND, Feb. 27—The Jordan Motor Car Co. reports that its production for the month of February was 350 per cent better than for February 1920

U. S. CHAMBER OPPOSES BONUS

WASHINGTON, Feb. 24—Seventy-two per cent of the membership of the Chamber of Commerce of the United States oppose cash bonus for soldiers, according to the result of the referendum vote recently taken. The vote was intended to put the Chamber's membership definitely on record and to supplement a declaration by resolutions adopted previously at two annual meetings.

Gain in Parts Trade Mounts to 30 Per Cent

Improvement in Conditions Is Reported from All Sections of the Country

NEW YORK, Feb. 27—Further evidence that motor and accessory manufacturers are receiving substantial orders was given at a group meeting last week of credit men from representative companies. The increase over recent months probably averages about 30 per cent. Following are paraphrases of some of the reports made at this meeting.

"Small local truck builders appear to be very active, especially in the East. We have received many small orders from builders of this type."

"One of our customers in the South who had a large account with us and whose notes we had carried for a year and a half recently paid us 20 per cent on account."

"New business is being placed for future delivery. We believe orders will increase from month to month."

"We have been very much surprised in the last month at the great number of inquiries we have received for new plant equipment and at the quantity of replacement business we have been able to get. These orders have not come from companies which are just going into the field but from old line plants which are replacing worn out machinery."

"We are going to have a good month this month and March will be a good month."

"Our schedules up to July are about 50 per cent."

"We are very much more active than we have been. As far as our automobile business goes we have specifications from practically all our customers up to July."

"We think we see a little change for the better in the western agricultural districts and we are looking for different conditions than have prevailed in the past year."

RUSHING DODGE, FORD FORGINGS

SPRINGFIELD, MASS., Feb. 27—Manufactures of automobile parts are going forward at an increased pace. Moore Drop Forging Co. is rushing forgings for Dodge Brothers and Ford cars. Bausch Machine Tool Co. is producing gears for Ford trucks and tractors at the rate of 300 a day, and is entering this week on the making of demountable rims of new design for the Franklin. The reorganized Harley Co. has its parts production under way. This seasonal activity shows a marked advance over a year ago.

FORD OPERATING IN JAPAN

DETROIT, Feb. 27—The Japanese assembly plant of the Ford Motor Co. at Negishi is now equipped to turn out 15 assembled chassis each working day of eight hours. Three former Detroit employees are in charge of the force of 46 Japanese laborers. Standard Ford methods have been adopted throughout.

The company estimates that there are 10,500 cars running in Japan, of which 4500 are Fords.

Milwaukee Parts Business Quickens

Passenger Car Builders Report Increased Production—Truck Prospects Encouraging

MILWAUKEE, Feb. 27—The automotive parts industry, which to a large extent marked time in January, experienced a quickening in February which was particularly noticeable in the last two weeks and is due to the more definite delivery schedules submitted by manufacturers, who through the national, district and local shows have been able to get a line on the possible demands of their market.

Passenger car builders in Milwaukee and vicinity also brought up production in the period now closing, compared with January. Tire manufacturing and distribution are far more satisfactory than last year at this time. The manufacture of trucks is making slow progress, but prospects are regarded as being more promising than a year ago.

Public Attitude Changing

Local dealers feel that the attitude of the public on passenger car prices has started to undergo a change which is taken to mean that a great many prospective buyers are satisfied that the bottom has been reached and little if anything is to be gained by waiting longer to buy.

There are, of course, many people who feel that before spring manufacturers will be forced to make further concessions in order to meet competition. The trade is engaged in combing prospect lists built up from patronage of the recent annual winter show and is meeting more and more success in closing sales. Business, however, is quiet, as might be expected at this period of the year.

Bassick Is Operating at 70 Per Cent of 1920

BRIDGEPORT, CONN., Feb. 25—Greater demand for automobile and cabinet hardware manufactured by the concern is credited as responsible for the fact that January orders of the Bassick Co. of this city showed an increase of approximately 100 per cent over the amount received during the same period last year, bringing the plant's production up to 70 per cent of what it was during the year 1920.

The man-hours per week at the local factory have been increased 20 per cent since the first of the year, as a result of the increased orders. A similar expansion in production is underway at the Newark, N. J., factory. The export business there is reported for the month of January as having increased by 10 per cent over exports for the month of January, 1921.

NEW STUTZ REFINEMENTS

INDIANAPOLIS, Feb. 27—A number of refinements have been made in the Stutz cars, particularly in the engine. It is claimed that the new manifolding system adopted gives a 50 per cent greater power output from the same cylinder dimensions. According to Chester S. Ricker, who has been employed as consulting engineer by the Stutz company during the past year, the new manifold is so arranged that changes in water jacket temperatures of 100 deg. do not seem to affect the operation.

The chassis weight remains the same as on the previous series, and the acceleration of from 10 to 60 miles per hour is claimed to be quicker than from 10 to 50 in the previous series. Complete specifications and details of the new product will be announced to dealers in the near future. It is stated that the Stutz company is about to enter an intensive merchandising campaign.

Says Industry Leads in Deflation Process

DETROIT, Feb. 27—The process of deflation has gone farther in the automotive industry than in any other, in the opinion of William Robert Wilson, president of the Maxwell Motors Corp. Discussing the general situation in the industry, he said:

The automobile manufacturer realizes that competition is keener than ever, that there must be no doubt about his product, but that the good car, correctly priced, need have little fear of a satiated market. Also, that conservative marketing and expert fingers on the pulse of demand will establish the automobile business on a more stable basis than ever.

The automobile dealer is, of his own wise, converted to a firmly conservative business policy. He knows that the day of the telephone order is gone for good—for the good of all concerned. He is in a frame of mind amicable to present conditions. He knows that he must go after business and is fully aware that the offer of real service is a genuine sales need. He is prepared to follow these dictates for on them his 1922 success is assured.

I believe the public is more deeply interested in the automobile than ever, but more critical. It is selecting cars more carefully and is more insistent on quality as evidenced by the New York and Chicago shows. The New York show drew record attendance, but not record sales, yet those manufacturers who offered a product of evident value found an agreeable amount of business.

Efforts to Reorganize Kelley Tire Abandoned

NEW HAVEN, CONN., Feb. 27—As receiver for the Kelley Tire & Rubber Co. of West Haven, Attorney Albert H. Barclay of this city has petitioned Judge George E. Hinman of the superior court here for authorization to expend $500 in advertising the concern's assets for sale. Efforts at reorganization have been abandoned, and the receiver will attempt to dispose of the plant and fixtures to the highest bidders, indicating that there is little likelihood that the many stockholders throughout the state will get anything out of the proceeds.

Hudson, Essex Sales Increase 100 Per Cent

Gain Over Year Ago—March Will See Plant on Practically Full Time

DETROIT, Feb. 28—February business of the Hudson and Essex companies will exceed that of the same month last year by 100 per cent, it was stated today by President Roy D. Chapin. Production in March will be increased to a point where it will run 200 per cent in excess of 1921 and will place the factory on practically full time operation, Chapin added. Releases on parts have been almost tripled in some instances.

Other manufacturers with whom he has talked declare business to be far in excess of early expectations, he said. Prospects for a strong spring and summer demand are excellent. All the shows thus far held have been more successful than expected and attendance has been record breaking in most cities. This is regarded as a positive indication of public interest in automobiles.

Financial Position Strong

Chapin said the sale of its new coach by his company has been large and that the campaign for business in enclosed cars has been successful. Dealers have been gratified at having a lower priced enclosed model.

The financial position of the Hudson Motor Car Co. is exceptionally strong. Its quick assets as of Nov. 30, 1921, were $5,804,630 and its current liabilities,$2,340,145. The total assets were $14,955,692. With a capital of only $1,987,260, the company had a surplus of $10,508,287.

Legislator Would Increase Truck Rates in New York

ALBANY, Feb. 27—A proposal to increase the rates for registration of automobile trucks in New York State has been introduced in the Legislature by Senator Seymour Lowman of Chenung County. The proposed rates would be identical with those now in force in Pennsylvania.

Senator Lowman's schedule is as follows: For each vehicle having a combined weight and carrying capacity of two tons, or less, an annual fee of $15; of two tons and not more than three tons, $20; more than three and not more than four tons, $25; more than four tons and not more than five, $30; more than five and not more than six tons, $50; more than six and not more than seven tons, $60; more than seven tons and not more than eight, $75; more than eight and not more than ten tons, $100, and more than ten tons, $150.

The excessive wear and tear on state highways resulting from increased use of motor truck transportation is cited as a reason for the proposal to increase the registration fees for the trucks. The passenger registration fee would not be changed.

Heavy Write-Offs Cause G. M. Loss

Balance of $38,680,770 Charged Against Surplus, Preliminary Report Shows

NEW YORK, March 2—A preliminary report of the General Motors Corp. for the calendar year 1921 shows a net income after ordinary charges of $5,784,782, but after charges for extraordinary losses and adjustments aggregating $44,465,552, there remained a balance of $38,680,770 to be charged against surplus.

A statement by Pierre duPont says that a statement of 1921 earnings would be misleading if attention were not called to the losses and adjustments in units undergoing liquidation and reorganization. To make this situation clear, he divides operations of 1921 into two classes, one of which includes the divisions thoroughly established and whose product is so standardized that it does not require readjustment. The other class includes divisions undergoing reorganization and rearrangement, including some cases of complete abandonment and liquidation.

Sales in Two Classes

Net sales in 1921 for the class A, or thoroughly organized units of the corporation, were $225,261,110, as compared with $370,288,235 in 1920. The net sales of the class B units, or those undergoing reorganization last year, were $79,226,133, as compared with $197,032,368 in 1920. The total for 1921 was $304,487,243, as against $567,320,603 in 1920.

The net earnings of the class A units were $29,671,494, while there were losses of $16,431,547 on the class B units, leaving net earnings from operations as a whole of $13,239,946. From these earnings were deducted interest of $5,281,084 on notes payable and $2,174,080 for the employees investment fund, leaving a net income after ordinary charges of $5,784,782.

Charges for extraordinary losses and adjustments were: write down of inventories Dec. 31, 1921, to cost or market, which ever was lower, $16,603,073; provision for refunds due dealers and distributors on account of price reduction, effective Jan. 1, 1922, $2,441,376; cost of cancellation of commitments, rebates on sales in 1920 account of price guarantees and other miscellaneous losses charged off in 1921, $11,421,102; special reserve established Dec. 31, 1921, to cover anticipated losses and unforeseen contingencies pertaining to 1921 on prior years but not at present definitely ascertainable, $14,000,000, making a total of $44,465,552.

President du Pont pointed to the satisfactory showing of the Class A units and added that adjustments in inventories with rearrangement and improvement in the quality of its product has placed the corporation in a position to conduct its operations in 1922 with every promise of profitable results. The corporation has taken all possible losses. The capital and surplus account, after allowing an equity of $352.39 per share on preferred and debenture stock, leaves an equity of $262,278,135 on common stock valued at $10 per share. This would leave a common stock surplus of $55,814,160.

Comparative Balance Sheet

A condensed comparative consolidated balance sheet as of Dec. 31, 1921 and 1920 shows:

	Dec. 31, 1921	Dec. 31, 1920
CURRENT ASSETS		
Cash in banks and on hand	$40,057,401.53	$47,332,842.21
United States Government Bonds	5,228.04	41,262.21
Marketable securities	27,009.31	34,096.31
Sight drafts against B/L attached and C. O. D.	4,677,241.39	9,667,580.59
Notes receivable	4,794,978.99	13,449,376.90
Accounts receivable and trade acceptances, customers and others	18,944,844.09	22,233,886.80
Inventories at cost or market, whichever is lower	108,762,625.35	164,684,678.72
Prepaid expenses	1,944,988.35	1,891,854.06
Total Current Assets	$179,214,317.05	$259,335,577.80
CURRENT LIABILITIES		
Accounts payable (and trade acceptances in 1920	$15,640,429.41	$27,160,681.23
Notes payable	48,974,996.29	72,421,451.45
Taxes, payrolls and sundries accrued not due	15,894,778.40	14,101,794.90
Accrued dividends on Preferred and Debenture stock, payable February 1	1,043,763.07	1,018,943.73
Total Current Liabilities	$81,553,967.17	$114,702,871.31

Wholesale Business for Lincoln Dropped

(*Continued from page* 533)

back-log of orders has been accumulated to warrant an expansion. From time to time additions will be made to the plant to permit the company to make parts that are now being bought. The manufacture of its own bodies is a detail that is being studied closely by the company.

Export business of the company will be handled through the Ford export organization ultimately, Leland said, but this will be passed over until the handling of domestic business is operating smoothly.

Regarding the most recent claim by the government against Lincoln, W. C. Leland expressed confidence that this would be dismissed as soon as the facts were subjected to intelligent scrutiny.

CANADIAN GARY INCREASES

TORONTO, ONTARIO, March 1—Increases in the prices of all its models are announced by the Gary Motor Truck Corp. of Canada, Ltd.

$100 to $550 Price Cut on Case Tractor

Company Is Building New Model with Capacity of 8 to 10 Plows

RACINE, WIS., March 1—Price reductions ranging from $100 to $550 on its farm tractors are announced by the J. I. Case Threshing Machine Co. The list follows:

	Old Price	New Price
Case 10-18	$800	$700
Case 15-27	1,680	1,420
Case 22-40	3,100	2,550

The Case company also is building a large size tractor known as the Case 40-72 for which the price has not been fixed. It will be powered with a Case four-cylinder engine and will have a plowing capacity of from 8 to 10 plows.

"WATERLOO" REDUCED $375

WATERLOO, IOWA, Feb. 27—The Waterloo Gasoline Engine Co. announces that the price of its Waterloo Boy Tractor has been reduced from $1,050 to $675. This brings the price below the pre-war level.

Material Cut in Price Made by Acason Truck

DETROIT, March 1—The Acason Motor Truck Co. has made material reductions in prices on its heavier models. The list follows:

	Old Price	New Price
¾-ton	$1,650	$1,650
1½-ton	2,485	1,950
2½-ton	3,295	2,750
3½-ton	4,295	3,450
5-ton	5,250	4,350

The one ton model which sold for $2,260 has been discontinued.

KEARNS MAKES REDUCTION

DANVILLE, PA., Feb. 28 — The Kearns-Dughie Motors Corp. announces a reduction in its model "H" 1-ton chassis from $1,600 to $1,150 and its model "M" 2-ton chassis from $2,200 to $1,650. The price of its model "H" chassis complete with its standard hand-made post express body is $1,350.

DUPLEX 3½-TON REDUCED

LANSING, MICH., Feb. 27—The Duplex Truck Co. has reduced the price of its model E 3½-ton truck from $4,250 to $3,500. The 1½-ton truck will continue to sell for $2,775, but the capacity will be increased to two tons and considerable equipment will be added.

The announcement contained in the Feb. 9 issue of AUTOMOTIVE INDUSTRIES, in regard to the bringing out by the Packard Motor Car Co. of a new line of single six cars was a mistake, and we are glad to make correction of that item.

N. A. C. C. Discusses Used Car Remedies

Comprehensive Plan Presented by Which Dealers Would Be Given Certificates

NEW YORK, March 2—Members of the National Automobile Chamber of Commerce met here to-day to discuss problems of importance to the industry. One of the most important was the used car situation. Several specific remedies were proposed.

One of the most comprehensive was presented through C. C. Hanch by Homer McKee of Indianapolis. It would provide for certified dealers who would be given certificates stating that they had agreed to put all used cars in such condition that they could be sold as certified cars. Under the plan a committee of manufacturers would be appointed to pass on rules under which the certified dealers would operate. There also would be a committee of four dealers in each locality, three of whom would not be interested in the car passed upon, who would be called upon to inspect each vehicle before it was offered for sale.

Advertising Values Favored

It developed at the meeting that there is opposition to attempts by factories to recondition their own product although the idea of having dealers do so is generally supported. Used car exchanges are favored, but some doubt was expressed of their success. General approval was given to the proposal to have factories advertise the values of old models.

Both manufacturers and dealers favor co-operative used car advertising, selling cars with a guaranty and used car shows. Appraisals by individual companies in each locality are favored.

The directors were supplied with a mass of information on the used car question provided by questionnaires sent to 2500 representative dealers. Reports from practically every section of the country were that there has been a marked improvement in the demand for used cars and that the shrinkage in the number on hand has been rapid in the past two or three months. Nowhere is the used car problem more acute.

A survey of trade conditions presented to the directors of the N. A. C. C. at their monthly meeting yesterday showed that sales were considerably better for February than for January, while March and April prospects are much better. Generally speaking, credits for dealers are much easier, particularly on the Pacific Coast. Truck sales also are picking up.

Gasoline Taxes Taken Up

The directors discussed at length the effort being made by various state legislatures to impose taxes on gasoline. It was the general feeling that a gasoline tax is not proper unless it takes the place of other fees.

The directors decided to adopt a standard safety code to be supplied motor car purchasers with their instruction books. Motor car operators will be told that they are engineers and that they have all the responsibilities of engineers.

A committee will be appointed to work with the Bureau of Simplified Practice of the Department of Commerce in standardization work as it relates to the elimination of needless sizes.

United Auto Stores Put in Receivership

(*Continued from page* 534)

concern has a fiscal office, and in West Chester, where there is a branch store, are reported to be many.

The petitioners in their prayer aver that to the best of their information and belief the contracts and transactions between the Stores company and the Guaranty company are void and fraudulent, and a temporary injunction is asked to restrain the further sale of stock and an injunction to prevent the distribution of any cash or property of the Stores company.

The court is asked to have the Guaranty company take all cash and other assets of the Stores company and make a complete accounting.

Well known Philadelphians were on the directorate of the Stores company as Carrier insisted on "minimizing risk" by strictly localizing each unit of the organization and establishing the policy that the manager and assistant manager of every branch must be stockholders. Many of the directors resigned last summer. The present directors are Carrier, president; H. J. Stokes, vice-president; Harry G. Coxe, treasurer; Rubens H. Peale, chairman of the finance committee of a bank in Schuylkill Haven, Pa.; M. H. Fox and W. A. Beisacher.

Gray Plans Unchanged by Durant $348 Car

DETROIT, March 1—President Frank L. Klingensmith of the Gray Motors Corp. said to-day that the plans of that company would not be changed in any way by the production of a $348 car by W. C. Durant. Practically all the equipment for the manufacture of the Gray car is now ready, and it is expected shipments will start about April 10. The price will be announced before that time.

"There is room for a number of manufacturers in the low priced field," Klingensmith said, "and we are looking for about 10 per cent of the business."

NO CHRYSLER ANNOUNCEMENT

NEW YORK, March 1—Walter P. Chrysler has not yet made any announcement of his plans for the future. He left last week for Palm Beach. W. C. Durant also is at the Florida resort. It is not considered probable, however, that Chrysler will join forces with Durant Motors.

Notes Are Renewed for Willys-Overland

Defeat Seen for Bank Creditors—No Mortgage on Property Now Likely

(*Continued from page* 532)

TOLEDO, Feb. 24—Charles B. Wilson was elected vice-president and general manager of the Willys-Overland Co. at the meeting of directors to-day. Two of the former Willys directors were also displaced by two more Toledo business men. William W. Knight of the Boswick Braun Co., a director also of the Fourth Federal Reserve Bank, Cleveland, replaces George W. Spencer, who resigned as secretary of the board.

Charles E. Bunting, president of the Bunting Brass & Bronze Co., replaces James E. Kepperly as a director.

Linwood A. Miller, who has been assistant to Vice-President Wilson, has been elected secretary to the company.

Together with Henry L. Thompson, W. L. Milner, George M. Jones and Gordon M. Mather, named last week, this new board will have nine of its eleven members representing Toledo banks and business interests.

Suit Filed Against Overland

TOLEDO, Feb. 27—An echo of the reduction of commitments from $46,000,000 in the spring of 1920 to about $19,000,000 at the close of 1921 came last week in the filing of a suit for $257,482 against the Willys-Overland Co. by the Dura Mechanics Hardware Co., a Toledo corporation.

Alleged failure on the part of the Overland to comply with an agreement and accept a number of window lifters, an automobile accessory, is given as the cause for the action in the petition.

The suit is filed in Common Pleas Court of Lucas County.

Willys Corp. Receivers Combat State

TOLEDO, Feb. 27—Receivers for the Willys Corp. have asked Judge Killits here for authority to combat the State of Ohio on the matter of an annual assessment against the corporation which, they allege, is levied and collected under a statute that is unconstitutional.

The claim of the State against the company is for $89,556.40.

The receivers want an injunction or restraining order against the State officials to prevent any action now to collect $77,875.13 of actual fee and $11,681.27 which is a 15 per cent penalty.

RUBBER FROM ISOPRENE

BEAUMONT, TEXAS, Feb. 27—It is now practical to manufacture artificial rubber from isoprene, a recently discovered product of petroleum, according to J. W. Newton, petroleum engineer and assistant superintendent of the local refinery of the Magnolia Petroleum Co.

2047 Cars Exported, G. M. Shipments High

Corporation Sent from Its Plants in Canada More Than 1200 Automobiles in January

NEW YORK, March 1—Export shipments by the General Motors Corp. from its Canadian plants to all parts of the world except England totalled 736 motor cars during January. This was announced to-day by the General Motors Export Co., following the issuance in Washington of the January shipments from the United States.

Additional shipments from Canadian plants to England, not included in the figure of 736, for sale in the British Isles were between 500 and 600, the exact number not being available here. None of these exports shows in the figures published at Washington yesterday. Thus, the General Motors shipments during January were from 1200 to 1300 cars, as compared with declared shipments from the United States of 2047.

The destination of the Canadian exports was announced as being Australia, Argentina, Brazil, India, South America, Mexico, some parts of Continental Europe and various countries of Latin-America. In December General Motors shipped 1338 cars from Canada, as compared with the declared exports from the United States for that month of 2652.

WASHINGTON, Feb. 28—The international shipment of American made automotive equipment continued throughout January at practically the same levels set in the closing months of 1921, when the impetus of new buying was begun as a result of the liquidation of overseas stocks. In announcing the January export totals to-day the Bureau of Foreign and Domestic Commerce instituted new classifications that have been so long desired by exporters.

The totals on the major items were as follows:

	January	December
Pass. cars..	(2047) $2,025,974	(2646) $2,349,282
Com. Vehicles	(464) 461,193	(511) 461,193
Parts, not including engines and tires	2,061,619	2,683,850
Tires, automobile only	1,412,602	1,391,635

The chief interest that will attach to these figures, in view of the fact that one of the largest producers, General Motors, has diverted its export shipments to Canada and that these do not appear in the United States totals given here, is in the classification of the different price and tonnage ranges of passenger cars and motor trucks. These are given in an adjoining table, but in recapitulating them, it is shown that the medium priced car class by far outranks in value either the lower or the higher priced categories and that the medium sized truck also held the center of the stage. This will be received with a distinct surprise by those executives of the industry who have held that the low-priced cars and the low capacity trucks were taking all of the present foreign business.

Passenger car exports are shown in three classifications, those valued at less than $800, between $800 and $2,000 and in excess of $2,000. The first classification shows 1330 cars valued at $691,-065, the second 994 cars valued at $1,-055,879, and the third 83 cars worth $279,-030. Thus, the medium priced cars were something like a third less in number than of the low-priced class, but something more than 50 per cent greater in value. The cars included in these classifications will be readily comprehended, but it must be remembered that the declared valuation applying here represents the dealer's price, with discount and, in somes cases, chassis price only.

The truck classifications likewise are three, up to 1 ton, from 1 ton to 2½ tons and above the latter figure. The export statistics show 222 of the 1 tonners, with a valuation of $114,067, against 220 of the medium sized models with a value of $287,531. The higher capacity trucks were 22 in number, valued at $59,595.

Throughout the export figures there will be seen the result of the new classifications that have been put into effect by the reorganized Bureau of Foreign and Domestic Commerce, with its new commodity divisions. These classifications are shown in a table herewith, excepting for tires. An advance statement, however, on the tire exports shows the January shipments to have been as follows:

	No.	Value
Automobile casings	80,511	$1,148,616
Other casings	1,577	4,875
Automobile tubes	48,935	116,385
Other tubes	1,134	1,158
Automobile solid tires	3,890	147,601
Other solid tires	22,610	8,231
Tire repair material		10,293

Exports, Imports and Reimports of Automotive Products for January, 1921 and 1922, and for Seven Months That Preceded

	Month of January				7 Months Ending Jan. 31			
	No.	Value 1921	No.	Value 1922	No.	Value 1921	No.	Value 1922
Automobiles, including chassis	7,378	$9,409,920	2,897	$2,528,292	87,411	$114,855,029	19,332	$17,544,094
Electric trucks and passenger cars	....	.....	26	41,125	....	.....	26	41,125
Motor trucks and buses, except electric	1,539	2,516,379	....	.....	14,404	24,543,664	2,727	2,851,223
Up to one ton	....	.....	222	114,067	....	.....	222	114,067
Over 1 and up to 2½ ton	....	.....	220	287,531	....	.....	220	287,531
Over 2½ ton	....	.....	22	59,595	....	.....	22	59,595
Total motor trucks and buses, except electric	1,559	2,216,379	464	461,193	14,404	24,543,664	3,191	3,312,416
PASSENGER CARS								
Passenger cars except electric	5,819	$6,893,541	....	.....	73,007	$90,311,365	13,708	$12,164,576
Valued up to $800	....	.....	1,330	$691,065	....	.....	13,330	691,065
Valued over $800 and up to $2,000	....	.....	994	1,055,879	....	.....	994	1,055,879
Valued over $2,000	....	.....	83	279,030	....	.....	83	279,030
Total passenger cars, except electric	5,819	6,893,541	2,407	2,025,974	73,007	90,311,365	16,115	14,190,553
PARTS, ETC.								
			Lbs.					
Parts, except engines and tires	...	$9,679,181	7,934,879	$2,060,619	...	$52,272,569	...	$16,303,166
Station and warehouse motor trucks	98	81,699	6	7,590	408	233,772	69	76,749
Trailers	...	....	33	21,003	..	.....	33	21,003
Airplanes and Seaplanes	17	114,775	1	5,000	53	386,955	19	126,165
Parts of airplanes, except engines and tires	...	24,999	47,374	11,479	..	108,310	..	57,958
BICYCLES, ETC.								
Bicycles and Tricycles	....	$533,967	69	$9,460	....	$2,907,056	....	$424,519
Motorcycles	4,322	1,473,390	1,010	284,883	20,870	6,529,051	4,054	1,127,415
			Lbs.					
Parts, except tires	....	.....	229,918	131,677	....	.....	229,918	131,677
Gas engines	148	48,734	172	36,494	2,507	460,342	799	167,128
Traction engines, except agricultural	44	60,532	1	2,425	250	440,611	10	27,252
Automobile engines	231	65,691	1,182	143,397	9,007	1,641,046	5,417	877,069
Aircraft engines	....	.....	3	5,275	....	.....	3	5,275
Complete tractors, except agricultural	2,513	2,866,172	2	8,851	17,436	17,085,020	135	205,718
Other internal combustion engines	1,741	334,697	383	29,551	10,566	1,581,000	2,761	360,278
Accessories, parts	490	375,176	....	....	4,571	2,835,111	631	688,472
IMPORTS								
Automobiles	54	$94,653	36	$62,543	860	$905,093	313	$485,038
Parts, except tires	....	93,841	....	60,307	....	860,122	....	346,779
All other	....	12,428	....	4,955	....	380,931	....	87,428
RE-IMPORTS								
Automobiles (free of duty)	62	$90,258	137	$254,835	2,132	$3,223,888	2,089	$3,188,002

MEN OF THE INDUSTRY

Major Mark L. Ireland has been detailed by the Secretary of War to represent the army on the technical committee of the Lincoln Highway Association to determine the design for the Ideal Section, which the association will construct this year for object lesson purposes. Major Ireland is a director of the Tractive Resistance of Roads Research being conducted by the army with the aid of the Massachusetts Institute of Technology, at Cambridge, Mass.

William E. Betts has been made advertising manager of the Studebaker Corp. He was formerly engaged in advertising and sales promotion work for Willys-Overland and the Overland Harper Co. of Philadelphia. He goes to Studebaker from the Olds Motor Works, where he was engaged in special sales promotion work.

Guthrie Shaw has been appointed manager of the Accessory Products Corp., now located in its new headquarters, 519 West Twenty-third Street, New York City. The company has been appointed metropolitan distributer for genuine replacement parts of the Arvac Manufacturing Co., the Oakes Co. and the A. J. Detlaff Co.

Henry Harnischfeger, one of the founders and president of Pawling & Harnischfeger Co., Milwaukee, and also head of the Associated Machinery Corp., has left with his wife for a trip around the world, and will be gone from six to eight months. He will visit branch offices and look over general business conditions.

Charles Hughes Connelly, formerly western sales manager of the Miller Rubber Co., has been appointed general sales manager of the Carlisle Tire Corp. He has had fifteen years' experience in factory work and the merchandising of tires. His headquarters will be at the company's general office at Stamford, Conn.

Fred D. Williams has been appointed assistant to President John S. Broughton of the United & Globe Rubber Co. Williams has been general manager of the L. H. Gilmer Co. of Philadelphia for the last three years and prior to that was associated with the Johns-Manville Co. and the U. S. Rubber Co.

William G. Brown has been appointed general sales manager of the A. H. Petersen Manufacturing Co., Milwaukee. For the last eight years Brown has been with the American Bosch Magneto Corp. and resigned as western manager, with headquarters at Chicago, to take up this new connection.

Paul L. Battey, formerly vice-president of the Arnold Co., Chicago, and for years chief engineer in charge of various industrial enterprises, including the Willys Corp. plant at Elizabeth, has established himself at 123 West Madison Street, Chicago, as consulting engineer for industrial plants.

Harrison H. Boyce, general manager of the Moto-Meter Co., Inc., and E. V. Hennecke, sales manager, are making a tour of the country investigating trade conditions in the automotive accessory field. The investigation will extend over a period of approximately two months.

B. F. Metcalf has resigned as employment manager for R. & V. Motor Co., East Moline, and will leave in a few days to take up duties in Mexico in connection with the Rockefeller Foundation, with headquarters in Vera Cruz. Metcalf has been associated with R. & V. Motors for six years.

Frank S. Bradley, formerly secretary and general manager of the West Haven Manufacturing Co. since its inception in 1896, has accepted the management of the Robert Manufacturing Co., New Haven, Conn., as its president.

J. F. Kelly, Jr., export sales manager of the Electric Storage Battery Co., Philadelphia, is now on his way to Mexico, where he will remain for a month, visiting the automobile show and returning by way of Cuba.

Albert Hirst, Inc., has given up his Ford agency in New York City to become distributer of the Gray car. His territory includes the states of New York, New Jersey, Connecticut and Rhode Island.

John McConnell has again affiliated himself with the United Alloy Steel Corp. as vice-president in charge of operation. He has been associated with the steel industry for a number of years.

C. H. Tyler has been appointed district sales supervisor of Earl Motors, Inc., with headquarters at Indianapolis. He has had eighteen years' experience in the automobile business.

A. M. Leoni, who until recently was connected with the Steinmetz Electric Car Co. of Baltimore, has joined the Electrocar Corp. of New York as consulting mechanical engineer.

Lake Jones has been appointed district manager of the southeastern territory for the Ajax Rubber Co., Inc. His headquarters will be in Atlanta.

January Output Reached 90,486, Including Ford

NEW YORK, March 2—Production of passenger cars and trucks in the United States for January aggregated 90,486, including Ford. The total for December was 78,995 and for November was 116,349. The relative gain over December for January by manufacturers excluding Ford was 40 per cent on passenger cars and 38½ per cent on trucks. Ford's relative gain for January over December was considerably below this figure.

There are no production figures for January, 1921, with which to make comparisons, but the output this year was much larger than for the same month last year. Most of the increase for January over the preceding month was in passenger cars ranging in price from $500 to $1,250.

Canadian Plant of Durant Motors Turns Out First Car

NEW YORK, March 1—The first car was turned out to-day in the plant of Durant Motors of Canada, Ltd. When W. C. Durant announced on Sept. 2 that he had purchased the munitions plant at Leeside, near Toronto, he promised that it would be in production by March 1 and operations have been begun exactly on schedule. The Canadian plant makes the fourth Durant factory now in production. The others are at Long Island City, Lansing and Muncie. All of them are working up to quantity production.

No announcement has been made yet as to where Durant will produce the new $348 car he is to manufacture for a group of parts makers, but it is probable they will be produced at first in one of his present plants, probably that at Long Island City.

Pierce-Arrow Lost $8,763,712 in 1921

Balance Sheet Shows Net Current Assets of $13,651,323; Liabilities $8,665,522

NEW YORK, March 2—A total loss of $8,763,712 for the year 1921 is reported by the Pierce-Arrow Motor Car Co. after all interest charges, depreciation, inventory adjustments and operating expenses. As a result the balance sheet on Dec. 31, 1921, showed a profit and loss depreciation of $4,422,165 against a profit and loss surplus of $4,541,646 at the end of the previous year.

The general balance sheet shows net current assets of $13,651,323 against $19,754,535 in 1920 and net current liabilities of $8,665,522 against $7,332,138. The current assets on Dec. 31 last were divided as follows: inventory $11,246,697, receivables $1,930,662, cash $473,963. The current assets for Dec. 31, 1921, were: Inventories $1,647,662, receivables $195,773, cash $1,338,100.

The current liabilities for 1921 were: notes payable $7,150,000, accounts payable $1,393,322, dealers deposits $122,200, making a total of $8,665,522. For 1920 the current liabilities were: notes payable $5,750,000, accounts payable $1,450,538, dealers deposits $131,600, making a total of $7,332,138.

Lincoln Places $1,000,000 Order with Body Company

BUFFALO, Feb. 24—The Lincoln Motor Co. has awarded to the American Body Co. of this city a million-dollar contract for the construction of bodies for its new four and seven passenger cars.

Filling of the contract is expected to take at least six months. The work will call for an additional force of about 300 expert body builders. The Buffalo plant is at present working on the first lot of orders.

The product manufactured by the body company will consist of the body enameled, upholstered and equipped ready for attaching to the chassis.

Liberty Motor Creditors Agree to an Extension

DETROIT, March 2—Bank and merchandise creditors of the Liberty Motor Car Co. have agreed to an extension of credit and the company has obtained $300,000 new money by giving a mortgage on its real estate and equipment. The new funds will be used to develop a popular priced model to pay off small creditors and further liquidate inventories.

In the 18 months preceding Dec. 1, 1921, the company reduced its bank loans by $333,975 and paid merchandise bills amounting to $434,973. President Owen states that sales now are ahead of production. The creditors who entered into an extension agreement have appointed an advisory committee through which it is hoped to obtain additional permanent capital.

FINANCIAL NOTES

India Tire & Rubber Co. reports that during 1921 without refinancing in any way and without issuing new stock the company materially reduced its bank loans, wrote off losses on raw materials and finished merchandise on hand exceeding $400,000 and greatly improved its financial position. D. A. Grubb, secretary and general sales manager, states that the company now has 340 per cent more new accounts than the year before and that compared with the half of 1920, sales from July to January in 1921 show an increase of 130 per cent, while the value of the December business was the largest in the history of the company, being 181 per cent larger than the same month the previous year.

Motor Wheel Corp. operating profits for the year ended Dec. 31, 1921, were $599,590. The company has $1,058,807 cash with total current assets of $3,752,105. Current liabilities aggregate $273,691. Inventories have been depreciated $266,249. With reductions for inventory deflation and Federal taxes the net profit for 1921 is $301,340. Preferred stock of $75,000 has been retired and additional purchases have been made from the sinking fund on the open market of $169,000, beside the purchase of a small amount of common stock. New business on the books is reported as the largest in the company's history.

Edmunds & Jones Corp., in its balance sheet as of Dec. 31, shows total assets of $1,995,582.28 and a surplus of $1,046,466.29. Assets include cash, $293,272.21; accounts and notes receivable, $203,906.48; inventories, $455,783.63. Plant accounts, less depreciation, are $967,996.92. Profits for 1921, less Federal taxes, are $97,580.79. Dividends paid on the preferred stock in the four quarters totaled $58,219. In a report to stockholders, President Edmunds states that despite heavy losses in the first six months of the year due to inventory inflation, the net profit for the year approximates that for 1920.

S. F. Bowser & Co., Inc., Fort Wayne, Ind., announces that forty-six executives are to be allotted portions of the common treasury stock of the company in a total amount close to $500,000. It is the plan to permit key men in the organization to purchase this stock on a basis that will enable them to pay for it easily in the next few years. S. F. Bowser and Allan A. Bowser who have held the greater part of the stock for years are releasing it in this manner as a reward for good service and to stimulate the men's interest in the business.

Republic Rubber Corp. operating costs have been greatly reduced, according to Receiver G. H. Booth. He states that important distributing connections are being made despite the sentimental handicap of the receivership and forecasts an increased volume of business which will make the company show an operating profit. The company is said to be employing 1,000 men.

Mason Tire & Rubber Co., Akron, reports sales of $8,986,000 for the 14 months ended Dec. 31, 1921. Current assets as of Dec. 31 are placed at $2,675,606; current liabilities, $859,863; surplus account, $11,139; inventory, $1,363,458. Cash account is stated to be $240,000; accounts and notes receivable, $1,071,767; notes payable, $774,613; reserves, $115,882.

Timken-Detroit Axle Co. has declared a regular quarterly dividend of 1¾ per cent on preferred stock, payable March 1, to stockholders of record Feb. 20. Resumption of common dividends was considered, but action was temporarily postponed.

Advance Rumely Thresher Co. has declared a regular quarterly dividend of 75 cents on the preferred stock, payable April 1, to stock of record March 15.

Goodyear Tire & Rubber Co.'s income account for the eight months ended Oct. 31, 1921, shows net profits after all charges of $3,273,845.

Hays Endorses Wells' Transportation View

WASHINGTON, Feb. 27—The time is not far distant when motor vehicle transportation will be universally recognized, in the opinion of Will H. Hays, postmaster general. His belief is expressed in the following statement:—

"A little while ago I read an article by H. G. Wells that I wish might be read by every business man; in fact it could be read with advantage in every school house in America. Wells traced the development of civilization to two factors, transportation and communication. These have been the vital factors that have enabled human beings to develop so marvelously and so rapidly in the last few hundred years.

"The Post Office Department is the government department of communications. We are all glad and proud to be associated with one of the vital factors in civilization. But we also touch upon transportation, and I look forward to a time not far distant when motor vehicle transportation will be universally recognized as one of the vital factors in the development of civilization."

AUSTIN OUTLOOK GOOD

LONDON, Feb. 17 (*By Mail*)—In a circular letter to shareholders of the Austin Motor Co., Birmingham, England, the chairman, Sir Herbert Austin, announced that the necessary agreements have been reached with bankers, creditors and the Government to a plan which provides sufficient working capital for carrying on the business successfully. It is stated that the prospects at the present time are very encouraging and the contracts entered into for the home market total well over £3,000,000.

U. S. TRACTOR BOND ISSUE

MENASHA, WIS., March 1—A bond issue of $250,000 was decided upon at the annual meeting of the United States Tractor & Machinery Co. and the capital was increased to $2,500,000. The bond issue, it is stated, is to provide for an immediate increase in factory capacity and equipment. J. M. Robinson was reelected president of the company and G. D. Harris vice-president and general manager.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

During the past week call money rates ranged from 4 per cent to 6 per cent, as compared with 4 per cent and 5 per cent in the previous week. Funds were in fair supply and brief periods of flurry, due mainly to withdrawals by out-of-town institutions, were succeeded by a firmness which developed toward the latter part of the week. In the time money market the rates ranged from 4¾ per cent to 5 per cent for all maturities from 60 days to 6 months. The rates for prime commercial paper remained unchanged at 4¾ per cent to 5 per cent.

The Federal Reserve statement as of Feb. 21 showed an increase of $4,900,000 in total reserves, which was the net result of an increase of $10,780,000 in gold reserves and a decrease of $5,880,000 in other reserves. Total earning assets showed an increase of $89,652,000, while total deposits decreased $85,293,000. Federal Reserve notes in circulation increased $3,561,000, while the reserve ratio also increased from 76.4 per cent to 78.1 per cent.

The total reserves of the New York institution declined $43,429,000. Other decreases noted were the following: $36,086,000 in total bills on hand; $74,522,000 in earning assets; $34,662,000 in total deposits. Federal Reserve notes in circulation, on the other hand, increased $4,753,000, and the ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 81.9 per cent to 87.1 per cent.

On Feb. 27, sterling exchange at $4.43¾ reached a new high record for the upward movement which has been in progress for some weeks. On Feb. 28 the discount on Canadian funds was only 2 per cent, which was a new low and marks an approach toward normal.

According to the Bureau of Labor Statistics index number, wholesale commodity prices for the month of January declined 7/10 of one per cent, as compared with no changes a month ago. With the exception of farm products, which showed a small gain, every group of commodities showed some recession. The general level still stands 48 per cent above the level for 1913, although it is approximately 45 per cent below the peak reached in the spring of 1920.

WILLS MAKE NEW CLOSED BODIES

MARYSVILLE, MICH., Feb. 27—C. H. Wills & Co. is now in production on three new closed bodies for the Wills Sainte Claire line, these being an imperial sedan, a town car and a limousine. The sedan is $3,575, and the town car and limousine, $3,850. The sedan has features of both a limousine and a sedan, having a glass partition which can be raised or lowered to divide the car into compartments. The limousine and town car have the same dimensions as the sedan, except that the space between seats varies.

INDUSTRIAL NOTES

Auto Body Co. has recently increased operations at its plant in Lansing, due to a contract with Durant Motors for open car bodies. January production was 85 per cent more than January, 1921. About 400 men of a normal force of 1000 are working. W. V. C. Jackson, vice-president, reports the company's indebtedness reduced greatly during the year.

Motor Wheel Corp. will open a Detroit office with M. W. Taber special representative in charge. R. I. Miner, in charge of the pressed steel division activities in Detroit, will occupy the same office. Taber's duties include the handling of both the manufacturers and distributor's end of the work. For the last year he has been in charge of steel wheel distribution in the Michigan territory.

American Brass Co., Kenosha, Wis., works, now owned by the Anaconda Copper Co., will add a new department for producing fine copper wire. The Kenosha branch has available a large group of buildings adjoining the main plant and formerly owned by another industry which is readily convertible for the wire mill.

Buckeye Manufacturing Co.'s plant and equipment at Anderson, Ind., has been sold at receiver's sale to James W. Sansberry, a local banker, for $45,100. The property was appraised at $170,000. The company formerly made automobiles, tractors and engines. The liabilities of the concern are said to approximate $200,000.

Rainbow Tire & Rubber Co., Delaware, Ohio, reports that, at the present rate of financing, production should start within the next few months. The factory is practically completed at a cost of $175,000 and is free from indebtedness. All directors were re-elected at the annual meeting.

Franklin Automobile Co.'s report to the Federal authorities shows that the number of employees who earned $1,000 or more during 1921 was only 10 per cent less than the number who earned that amount during 1920.

Visible Pump Co., Fort Wayne, Ind., which is moving to Findlay, Ohio, has leased the former property of the Grant Motor Co. in that city and will begin operations there within a month.

Ashtabula Tire & Rubber Co. has purchased the plant erected by the Pierce Tire & Rubber Co. at Niles, Ohio, some years ago and will rehabilitate it for operations not later than March 15.

Kirkland Bros. Machine Co., Detroit, has organized a company of the same name in Springfield, Mass., to act as a factory branch. Incorporation is for $250,000.

Storm King Manufacturing Co. has moved its factory equipment and offices from Winneconne, Wis., to Hortonville, Wis.

American Bushings Co., Marysville, Mich., is operating with two shifts, due to the receipt of a large volume of orders.

India Tire & Rubber Co. has established a branch warehouse at 250 West 54th Street, New York City.

DUAL TRACTOR PLANT SOLD

DECATUR, ILL., Feb. 27—Bondholders of the defunct Dual Tractor & Truck Co. have purchased the company's plant and have changed the name to the Decatur Machine & Specialty Co. A charter has been granted by the secretary of state to operate a machine shop with the capital stock fixed at $50,000. All bondholders of the old company were given the privilege of exchanging their claims against the old company for stock in the new. Most of them accepted the offer and the plant has been re-opened. It will specialize in motor vehicle work of a special or engineering type.

Argentina Harvest Returns Satisfactory

BUENOS AIRES, ARGENTINA, Jan. 17 (by mail)—Returns from the present harvest are quite satisfactory and the demand for wheat seems more active. This also applies to livestock, and the sales of wools and hides have almost reached a normal volume. The tendency is upward, and each week sees further advances

Most car stocks have been liquidated, and new orders will be required commensurate with present day requirement. The truck market, however, remains dull, but tires and tubes are more active than for many months past, especially in the smaller sizes.

The belief is that within a few months the present progress of Argentina on the road to recovery will be speeded up considerably, and that by the latter part or end of 1922, business will again be booming.

Studebaker Denies Report of London Factory Branch

SOUTH BEND, IND., Feb. 28—In the absence of President A. R. Erskine, N. R. Feltes, treasurer of the Studebaker Corp., declares there is no truth in the rumor that the corporation is negotiating for the purchase of the Ensign car factory near London, England, to be used as a factory branch.

Report from London

LONDON, Feb. 14 (*By Mail*)—The Studebaker Corp. is reported to have bought the recently built Ensign car factory at Willesden Green, London, N.W. It is stated that it is not intended to assemble cars at this plant but to use the facilities available for repairing and distributing Studebaker products. At the same time the company, it is said, will continue to occupy its present showroom on Gt. Portland Street.

HANSON ABSORBS COMPANY

ATLANTA, March 1—George W. Hanson, president of the Hanson Motor Co., announces that the company has absorbed the American Motors Export Co. of Jacksonville, Fla., and that the two industries have been merged. The joint company, which is to be known in future as the Hanson Motors Co., will maintain headquarters in Atlanta and also operate a plant at Jacksonville.

METAL MARKETS

ONCE more steel mill operations have attained a rate which, if it can be slightly enhanced, will permit of reductions in the cost of production that should enable the majority of mills to make a fair profit at prevailing market levels. It is axiomatic of most steel mills that when three-fifths of their capacity is engaged in production the balance will come out on the right side of the ledger. Sheet mills are operating at a rate of two-thirds to three-quarters of capacity, in some instances even higher. The leading interest is reported to be operating at 70 per cent of the capacity of its sheet mills.

Taking the industry as a whole, however, it is operating at somewhere between one-half and two-thirds of its capacity and the goal of those mills which are now turning out slightly more than one-half of what they could produce, if their entire capacity were engaged, is to get enough orders on their books to permit of operating their plants at three-fifths of their capacity. Amid this intensive effort to speed up the momentum of the demand upward changes in prices would defeat their own purpose, while reductions would upset the ultimate aim of producers; i.e., modest profits based on the prevailing market.

Individual concessions of a minor character, when specifications are attractive, fit, however, very nicely into this scheme of things. Here and there buyers have voiced uneasiness because of the recent advance in the pig iron quotations of some of the larger interests. In a large measure this attempt to lift the pig iron market to a higher level was the result of increased demand for steel. As a direct consequence of this latter condition steel mills are now working up all of their pig iron production, whereas up to a short time ago they competed for business with the merchant furnaces. The latest market letters of the leading pig iron sellers paint a glowing picture of the better feeling that has come over the market. Undoubtedly there has been a perfectly natural increase in the demand concurrent with the increased melt by foundries.

Pig Iron.—Thousand-ton sales to automotive foundries are few and far between. Those that have been made carried prices somewhere between the old and new asking prices. Most of the automotive buying is in carloads.

Steel.—As the result of improved automotive demand, alloy steel producers are operating on a much more satisfactory basis. Demand for skelp for automotive purposes had broadened impressively, a Detroit interest being reported to be in the market for a large tonnage of strip skelp. Some sales of sheet bars at $29 appear to have been made recently. Very little change is to be noted in the sheet situation, prices holding steady with slightly less fresh business in full-finished automobile sheets. Automotive interests are placing more liberal orders for forging bars, and cold-drawn steel bars continue in active demand. Pittsburgh strip steel producers report sales of attractive tonnages to automotive interests. There has also been a slight revival in automotive demand for bolts and nuts.

Aluminum.—While the sheet market is fairly steady that for virgin ingots, 98 to 99 per cent pure is still debatable ground with odd lots of imported metal changing hands at slight concessions from prevailing quotations.

Copper.—The market continues weak.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

FOREIGN SHOWS

March, 1922 — Santiago, Chili, Annual Automobile Show.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria

Sept. 15-20—The Hague. Automobile Show.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

November — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

CONVENTIONS

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Mar. 24, April 28, May 26.

June 20-24 — White Suplur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Kansas Sales Pivot Is Small Town Bank

Public Wants to Buy, Credit Is Ample, But Financiers Halt Procession

KANSAS CITY, MO., Feb. 27—The public wants cars and is ready to buy them. The dealers are ready to sell them. Credit facilities are ample. The bankers in smaller towns stop the procession.

Therefore, the chief effort of many distributors here is to see that bankers adjust themselves to the other conditions—and let dealers and public have money for cars.

The campaign to sell the idea of motor cars to bankers is not confined to this personal contact of travelers and dealers with bankers. The distributor himself keeps in close touch with each of the bankers in his dealers' towns. The wholesale manager himself knows most of them and sends letters to them occasionally.

One type of letter has proved of very great value. This is the letter announcing new developments in the motor car field; sometimes a factory circular letter with appended note from distributor, sometimes a personal letter from the distributor giving or calling attention to the information. In this way the banker is kept posted on the industry; and when dealer or traveler makes some statement the banker knows what he is talking about and responds the more cordially.

Cleveland Business Men Interested in "Glenwood"

CLEVELAND, Feb. 27—Most of the officials of the Glenwood Motor Car Co., which has purchased a fifteen acre tract at Youngstown on which will be erected a factory for the production of a car to be known as the "Glenwood," are Cleveland business men.

B. J. Cline of this city is president of the corporation. He was associated with the Pierce-Arrow Motor Car Co. at one time and later was production manager for the Chandler Motor Car Co. During the war he served with the Aircraft Board. T. D. Lamb, president of the Hess Body Co., is treasurer; Captain R. L. Queisser of R. L. Queisser Co., is secretary, and William H. Graham, a florist, is a director.

The Glenwood company is a $5,000,000 corporation with 50,000 shares, $100 each, of preferred stock and 200,000 shares of no par common. The company has under control an engine which has developed what is said to be unusual power, but, for the present, Cline has no announcements to make about the car.

McDonald Is Honor Guest at N. A. C. C. Road Dinner

NEW YORK, March 2—Thomas McDonald, chief of the Bureau of Public Roads, was the guest of honor at a dinner given by the Highways Committee of the National Automobile Chamber of Commerce at the Hotel Ambassador last night. Most of the guests were representatives of newspapers, trade and business papers.

The purpose of the meeting was to discuss the present status of highways in the United States and to enlist widespread co-operation in highway construction and maintenance work which will be carried on in the next few years. Edward F. Jordan, president of the Jordan Motor Car Co., president. George M. Graham, vice-president of the Chandler Motor Car Co., emphasized the essential character of motor vehicles.

FORD BUILDING 3400 DAILY

DETROIT, March 2—The Ford Motor Co. is operating at the rate of 3400 cars a day on a four day a week schedule. The March schedule calls for between 60,000 and 65,000 cars.

PAYS JACKSON CREDITORS

NEW YORK, March 2—Associated Motor Industries, Inc., has made a small payment to the creditors of the Jackson Motors Corp., which was taken over a few months ago by the Delaware corporation as part of a proposed automotive merger.

Clouds Overhanging Iowa Start to Break

Improvement in General Business Conditions Reflected in Outlook of Trade

DES MOINES, Feb. 27—There is a break in the rather dark cloud which has hung over the motor car horizon in Iowa during the past year. The month of February sees the most cheerful outlook which Des Moines dealers and distributors have encountered in many a moon, and there is evidence that at last the corner has been turned and that business conditions are on the upgrade.

As a concrete evidence of the improvement, it is noted that in the first fifteen days of February 102 new passenger cars were registered with the state automobile department for Polk county, in which Des Moines is located. There were nine new trucks registered during this period.

Prices Advancing.

Improvement in business conditions in general and better prices for farm crops in particular are credited for the better outlook of the trade. During the past six weeks prices of wheat, corn, oats and hogs have shown a steady advance, and as Iowa is a leading corn and hog raising state this improvement is bound to put the farmer in a much better position. Corn has practically doubled in price within the last ninety days.

While the recovery of the farmer and his return to the market is to be a slow process, there are evidences that he has already started back. An inquiry conducted by one automobile dealer among 689 farmers in his territory elicited the information that of that number 87 made a definite statement that they would buy a new car this spring. Last year a similar inquiry was conducted by this dealer, and of 712 farmers interviewed only 13 made such a definite statement.

The condition in the truck business would also seem to show some improvement, particularly in the eastern cities of Iowa. This condition is, however, confined almost entirely to city business.